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SOUTH AMERICA

TROPICAL SCENE ON THE LOWER MAGDALENA

SOUTH AMERICA

BY

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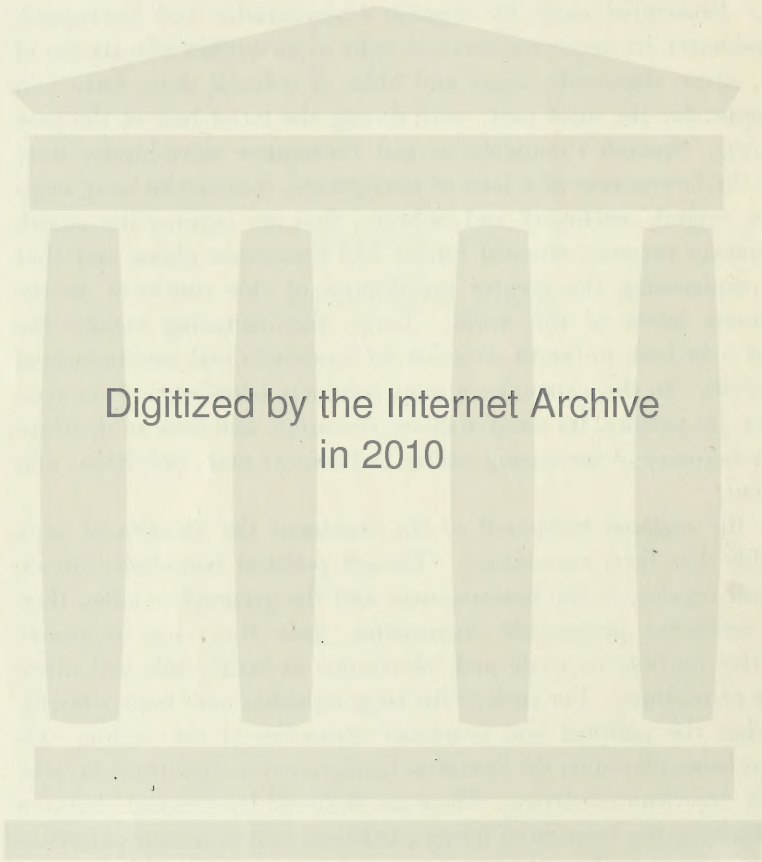
PREFACE

South America, after centuries of slow political, economic and social evolution, stands on the threshold of a marked period of progress. Penetrated early by Spanish Conquistador and Portuguese slave-hunter, its major resources, in spite of an outflow of a stream of gold, silver, diamonds, sugar and hides of colonial days, have lain dormant, for the most part, until during the latter half of the past century. Spanish Conquistador and Portuguese slave-hunter were only the forerunners of a host of immigrants, commercial men, engineers, capital, machinery and railways, that are tapping the wealth of Andean recesses, tropical forests and temperate plains and that are emphasizing the greater possibilities of this continent in the economic fabric of the world. Large manufacturing regions the world over look to South America for foodstuffs and raw industrial materials. In this expansion a more complete knowledge of the continent, its peoples, its many regions, resources, and lines of development becomes of increasing utility to business man, politician, and student.

In the regional treatment of the continent the identity of each republic has been maintained. Though political boundaries divide natural regions, to the business man and the geographer alike, they are significant geographic phenomena, since they may represent effective barriers to trade and intercourse in tariff walls and other trade restrictions. For each of the large republics one chapter briefly sketches the political and economic expansion of the nation, emphasis being placed on the historical background so important in most South American countries. These are followed by regional chapters emphasizing the relation of living conditions and economic activities to the natural environment.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As this book goes to press I feel a sense of great obligation to many people who have been associated with me, in one way or another, during the past seven years.

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I am indebted to Dr. Wallace W. Atwood and the Board of Trustees of Clark University for making possible extended travel and research on two trips on which the author visited each of the several South American republics and British Guiana; to Miss Mabel Ripley for assistance in the preparation of the dot maps of Brazil; to Mr. Harley P. Milstead for the dot maps of Peru; to representatives of the Bureau of Foreign and Domestic Commerce in Washington for statistical information, and the offices in South America for information, contacts and other aids in the field; to the Pan-American Union, Washington, for the loan of publications, field contacts and replies to many inquiries; to the officials of the several government departments in all the South American republics for statistical information, permission to gather data from government files, contacts and replies to numerous questions; to the representatives of W. R. Grace & Company, Cerro de Pasco Copper Corporation, Guggenheim Tin Company, Lautaro Nitrate Company, Andes Copper Company, Arica-La Paz Railway, Swift and Company, International Harvester Company, American Bauxite Company, Dutch-Shell Petroleum Corporation, Tropical Oil Company, and the United Fruit Company for information, courtesies and aid that made difficult field work a

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C. F. J.

Worcester, Mass.

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SOUTH AMERICA

CHAPTER I

IS SOUTH AMERICA A CONTINENT OF OPPORTUNITY?

South America! At mention of the words, what a pageant of events unfolds itself! Balboa heroically struggles to cross the isthmus and dashes into the waters of the great ocean discovered. Pizarro and his army ride to their ruthless conquest of the vast and highly developed Inca Empire. They give Spain nearly a quarter of a continent, fill the coffers of the motherland with gold, and obtain plunder enough to make every man of the expedition wealthy for life. In the eastern lands, the Paulistas march on their Indian slave-hunting expeditions, seeking at the same time gold and diamonds, giving Portugal and later Brazil nearly half the continent. On the placid waters of the Caribbean sail Spanish galleons loaded to the waterline with their wealth of gold. In and out of the protected island havens of the Caribbean dart Drake, or Hawkins, or Black Beard, snatching treasure ships and wealth from the Spanish fleet. Far to the south, San Martín scales the mighty Andes in one of the world's greatest military feats, while his northern brother-soldier—Simon Bolívar the Liberator—fans the flames of liberty that broke up one of the most extensive colonial empires of all times.

The years roll on and there arise the anxieties and disappointments of an ill-equipped people attempting to establish true republican forms of government. Preparing the way for the invasion of that fertile land by cattleman and farmer, General Roca fights in his relentless campaign against the Indians of the Pampa. His activities contribute to the rise of Argentina to the front ranks as an exporter of foodstuffs and raw materials. A flood of capital and men brings forth the wealth of tin, copper, nitrates, and oil of other lands. Lindbergh glides over sea, mountain, and plain in an epoch-making flight, as part of a program introducing air-mail and passenger service to every political division in South America.

What has been the interplay of physical, political, and economic

elements accounting for the distinctive character of this continent in its varied developments?

PHYSICAL SIMILARITIES AND CONTRASTS: NORTH AND SOUTH AMERICA

South America, in many respects of physical make-up and economic evolution, resembles its sister continent to the north; but contrasts are none the less striking. The two continental masses of nearly equal size [1] present the same triangular form, with the base to the northeast and sides of nearly equal length converging to the south; but the outline of North America is far more irregular. In the western portion of each are the great ranges of the young Cordillera, widening out in places to embrace broad plateaus; but the ascent from the plains or the sea into the Andes is much steeper, in most sections, than that into the Cordillera of North America. East of the Cordillera, from the Arctic to the Gulf and from the Caribbean to the South Atlantic, stretch the vast interior plains, drained by great river systems. And farther east are two areas of old worn-down mountains separated respectively by the St. Lawrence and Amazon Valleys.

These broad similarities are more than balanced by striking contrasts of vital significance, and on the whole, much more favorable to development in North America than in South America. First consider the latitudinal position and extent. North America lies chiefly in the temperate or subarctic zone; South America chiefly in the tropics. Consequently, half of South America has undiluted tropical conditions; were it not for the highland areas in the tropics a larger portion of the continent would feel the effects of enervating heat and humidity. In North America nearly three-fourths of the people dwell on plains below one thousand feet above sea level; only in the tropical portion of the northern continent do the people as a whole choose the highland areas in preference to the plains.

[1] A comparison of the continents:

Continent	*Area in Square Miles*	*Population*	*Population Density*
Asia	17,200,000	900,000,000	52.3
Africa	11,600,000	142,000,000	12.24
North America	9,400,000	145,000,000	15.42
South America	7,200,000	75,000,000	10.41
Europe	3,900,000	465,000,000	119.23
Australasia	3,300,000	9,200,000	2.78

But in the southern continent only one-third seek a plains habitat, and these chiefly in the temperate portion. In North America the broadest portion of the continent takes in the temperate plains with medium precipitation and a marked climatic rhythm exceedingly favorable for machine agriculture, but the similar portion of South America occupies but a fraction of the land mass. Furthermore, most of the plains of South America support a dense growth of

FIG. 1. ALONG THE DEMERARA RIVER

In the hot humid lowlands of South America the native population has been unable to make much advance in the face of luxuriant vegetation, insect pest, and disease.

tropical hard woods or tall coarse grasses which have not lent themselves to occupation and development as have the forested or grass-covered plains of North America. The very luxuriance of vegetation, not to mention the enervating heat and humidity of these areas that make the population exceedingly inefficient, is a great hindrance (Fig. 1). Throughout the forests communication, except on river highways, is far more difficult than on the rugged Andes. Also the heavy growth of timbers on the tropical lowlands and the rapid rise of the land near the sea in much of the continent have made the provision of efficient means of transport difficult and expensive.

With reference to soils and mineral resources South America suffers in comparison with its sister continent. Where the climate is dry or where there is a marked dry and wet season the soil in mineral constituents usually is fertile, but in the very rainy regions soils cleared of forests are subject to excessive leaching and soon become deficient in available plant food. So much of South American lands fall in the latter class. It is a question whether the hot, humid lowland soils can become permanently valuable farm lands without constant fertilization or rehabilitation. Both continents possess a variety of mineral resources including huge stores of oil. But coal, the basic source of power during the nineteenth century and the early portion of the twentieth for the great manufacturing nations of the world, is restricted in South America to scattered, small, isolalated deposits of only medium quality. No deposits as yet yield good coking coal. Consequently, the minerals that are produced move to the northern hemisphere for fabrication. However, water power and electricity may alter this movement somewhat.

HISTORICAL COMPARISONS AND CONTRASTS

If physical conditions favor the northern of the two Americas, the native populations, the introduced peoples, the purposes and results of settlement, show potent differences in directing the course of events, forming the character of communities that have evolved and in pointing the way to advance.

Native Indians.—When discovered, both continents were peopled by races entirely unlike those of Europe. Over most of the area they lived in a savage state, but in the mountainous arid portions, regions protected from invasions by natural conditions, the peoples had reached a rather high order of development—such were the *Aztecs*, the *Mayas*, the *Chibchas*—in the eastern range of the Andes in Colombia, the *Quichuas* in the plateaus of Ecuador and Peru, the *Yuncas* (*Chinus*) and *Ancons* of Coastal Peru and the *Aymarás* of Bolivia, all these from Ecuador to Chile being Inca governed peoples at the advent of the Spaniards. They possessed none of the European domesticated animals, except the dog, but in some areas they had domesticated native animals—the llama, for example. They practiced agriculture by irrigation, stored up food and carried on manufacturing in various lines. For the most part the plains Indians had not advanced beyond

the hunting and fishing stage, yet those in North America certainly had surpassed those of South America, by far. The Iroquois, Algonquins and others, considered to be hunting and predatory tribes, of eastern North America, though below those of the arid southwest, had strong tribal organization, built substantial Indian villages, cultivated corn and pumpkins and hunted in organized groups. Most of the lowland Indians of eastern South America lacked even a strong tribal organization, practiced promiscuous intermarriage, lived in individual brush or grass shelters, and devoted practically all of their time to procuring food.[2] Of course, some of the tribes of the Arawaks of the Brazilian Plateau and the Indians of the Pampa, fierce and warlike people of the chase, differed materially from the forest or savanna Indians of the warmer parts of the continent. Of the tribes inhabiting the southern portion of the continent only the Araucanians had made material advance. Still in a seminomadic state, they had reached about the same cultural level as the Iroquois and the Algonquins. Thus the Indian population of the two continents showed significant similarities at the time the Europeans came upon the scene.

Settlement by the Europeans.—The different peoples entering the two continents, their purpose and method of settlement and subsequent responses, have aided greatly in the almost complete divergence of the development of North and South America, while physical differences have accentuated political and social forces.[3]

The North Europeans entered North America in large numbers a century later than the Spaniards and Portuguese did South America. They came in family groups [4] to escape religious persecution in Europe; they established permanent homes in Maritime Canada, New England, and the middle and southern colonies. They brought their grains, animals, and methods of farming to which the environment was fairly well adapted. They cleared the forests and established permanent settlements on an agricultural basis, which meant for intensive and close settlement. Over the wooded region they

[2] Though the Tupi-Guaranies were chiefly hunting and fishing people, they practiced a crude type of agriculture, raising manioc, corn and tobacco.

[3] In the comparison which follows, North America is considered as that part entered and developed by North Europeans, since the part south of the Rio Grande, in historical, political, and economical evolution, is similar to the remainder of *Latin America*.

[4] Except the first wave of French explorers and fur traders.

discovered seminomadic Indians, mostly fierce fighters, who contested their right to the lands with the invaders. The colonists found the Indians unwilling to work and unfit for slaves or any kind of regular labor. The men, having brought wives from Europe, had no need for Indian women. Consequently, the Indians were swept from the land and population groups of pure European extraction were planted in new lands of marvelous possibilities. This type of settlement was further favored by the failure of the colonists to discover gold, by the great wealth of fish and forests of the northern settlements and the fertile coastal plain soils for tobacco to the south, all backed by a significant Appalachian barrier that held the colonists to the coastal strip for more than a century.

In South America the Spaniards and Portuguese, entering the continent a century earlier, ushered in an entirely different scheme of development. After the discovery of gold in Haiti, the discovery of the Pacific, and the conquest of Mexico, the chief aim of the Spanish advance into South America became the desire for conquest in the search for gold. In a few years Spanish control extended from the Caribbean to Middle Chile, embracing the territory ruled by the advanced Indian groups of the continent (Fig. 2). Indian homes and public buildings were demolished for their ornaments of gold, a stream flowing towards Spain. In the conquest and early settlement only men came to the colonies. Soldiers took Indian wives and there appeared in two or three generations a large mestizo or half-breed population, which has increased to constitute much of the upper class and practically the whole of the middle class in all except two republics. Only in the River Plate region were the fierce nomadic Indians killed off or driven out; elsewhere intermixture was great. In the western part of the continent after the Inca and Chibchas rulers were replaced by *Conquistadores*, soldiers parcelled out the land in huge estates and enslaved the sedentary Indians for work on estates or in the mines.

Though no gold was discovered in early Brazil, a more complex stratification of society developed. As sugar cultivation developed along the coast as the chief industry, the plateau was all but depopulated by slave-hunting expeditions to furnish laborers for the plantations. Finding the Indians thus rounded up inadequate for the work, the Portuguese brought in negroes in large numbers. With a

large slave or laboring class, none of the upper class people of Brazil did any manual labor. This was true also in Spanish America. To this condition the enervating heat and humidity played a part; the Europeans soon discovered that they could not endure hard labor in the hot humid lowlands. But the type of immigrant who came is also significant. While the immigrants who came to the English colonies

Fig. 2. Central Cordillera, Antioquia, Colombia

One of the regions entered easily by the Spaniards, the Central Cordillera of Colombia, has yielded a stream of gold and has become a productive agricultural region, mountain and valley being a patchwork of pasture and crops.

were mostly small farmers or townsfolk of the trading class, the Spaniards consisted chiefly of adventurers, seekers of fortune, often from aristocratic Spanish society, the type which naturally would not take to arduous tasks. This dislike for manual work is an outstanding characteristic of the upper classes today throughout South America.

As significant as these differences, were those related to the sphere of government and of administration. A cardinal policy of both Spain and Portugal was that colonial trade and immigration should remain a complete monopoly for the mother country. In conformity

to this policy the jealous restrictions placed on the colonies produced dire results. Few immigrants came; except for the regulated flow of gold and silver from the western part of the continent and of sugar from Brazil, colonial commerce was stifled. Except for mining and sugar production in Brazil, all local industries were discouraged; usually they were tolerated only when they did not yield a commodity that competed with one produced in the mother country; the most open-handed contraband trade of all time developed and with it widespread corruption and evasion of edicts and a disrespect for law, today one of the weakest features of South American politics. Also all power remained with the crown, exercised directly from Spain and Portugal or through a viceroy or a captain-general. In contrast to these features the English colonies for the most part were left to govern themselves. Governors sent out from England interfered little with the power of colonies to regulate their own affairs; when the crown did assert its desires, the action served only to increase the independent action of the colonists. Consequently, trade, agriculture, and even industry flourished early. The English colonists gained compactness, unity of action, financial power and training in government that the South American colonists never achieved.

The Advance After Independence.—If developments during the colonial period increased the contrasts between North and South America, those following Independence augmented the differences still more. Deprived of all means of self-government during colonial times, the South American people at the time of independence were ill-equipped to pick up the reins of government. Obstacles to the consolidation of Spanish domain proved insuperable; neither a monarchy as conceived by San Martín nor a federation as outlined by Bolívar was possible. Great distances between centers of population, the lack of means of intercourse, intense local jealousies—engendered through long years—marked differences in the physical environment making for contrasted interests, material outlook to the sea in different directions, and differences in population all caused the break-up of the Spanish domain of South America along the lines of the old administrative units. At the close of the Wars of Independence all the new republics were greatly handicapped. Manufacturing industries did not exist; farming was in a low state of development,

most of the land being held in huge estates and poorly tilled by Indians or mestizos, whose condition was little if any better than serfs; the output of the mines fell off greatly; means of transport were not present; the countries torn and disrupted by almost constant political strife for more than half a century could not advance, even if other conditions had been auspicious (Fig. 3).

How strikingly different was the rôle of the North European colonies in North America. Gaining independence nearly a half century earlier, the compact settlements along the Atlantic seaboard spilled over the Appalachian barrier into the Mississippi Basin; thence across the great plains, over the Rocky Mountains, the deserts, and the Cascade and Sierra Nevada Mountains into the Pacific Coast Valleys, remaining one nation over a territory thirty times greater than was occupied at the close of the Revolution. To the north from Maritime Canada and the St. Lawrence the English advanced to the Pacific, creating another great country. From a few million people, a small fraction of those in South America at the time of independence, the combined populations of Canada and the United States have increased to almost twice the total of South America today. For more than half a century a constant stream of immigrants poured into these countries before any went to South America. In agriculture, transportation, industry, education and sanitation, and finance they far outstripped the republics of South America. So striking was the development to all the world that the nineteenth century has been called "the century of North America."

FIG. 3. A GROUP OF INDIANS

The community Indians of Bolivia, isolated, illiterate, oppressed for centuries, and closely bound to the land, can not be expected to take an active part in a republican form of government or any major move for advance; barefoot children in a region always cold.

Nevertheless, during the last fifty years, after centuries of belated development, the republics of South America have staged a re-

markable advance. The population of the continent has doubled; immigrants have flocked to Argentina, Brazil, and to a lesser extent to Chile—although other portions of South America seem powerless to attract immigrants in spite of a great need for population; in increasing measure the republics have attracted commercial men, bankers, capital, miners, railway builders, construction engineers, and supplies for the development of resources of mines, oil pools, forests, farms and pastures (Fig. 4). So phenomenal is this modern expansion that Theodore Roosevelt in 1914 while on his South American

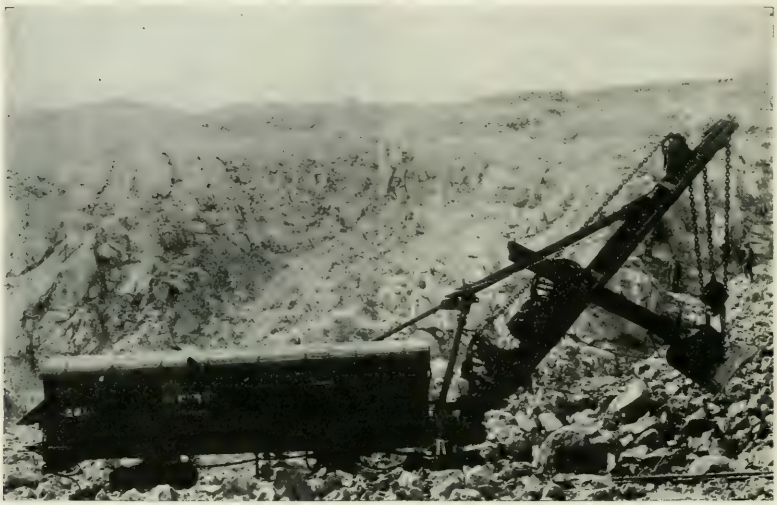

Fig. 4. Chuquicamata Hill, Chile

Foreign machinery, money and men open up the vast stores of minerals of the continent of South America for shipment and manufacture overseas.

expedition declared, "I believe that the present century is the century of South America."

It is true that more than ten billions of foreign capital have entered this southern continent; the trade has increased several fold; railways have covered the Central Plateau of Eastern Brazil and the Pampa and have pierced the Andes to tap the mineral stores in the innermost recesses; oil fields pour forth a flood of black gold; packing plants consume an almost continuous line of stock; the forests have begun to go down in the face of the woodman's ax; and in the humid tropics small comfortable places in which to live have been made of

veritable pest holes with modern science and medicine. But does it necessarily follow that the "twentieth century is the century of South America"? Nearly half the continent, with a population density of less than two persons per square mile, rests in a stage of development, little, if any, in advance of what it was when the Pilgrims set foot on New England soil. The fanciful hope of temperate people of a great potential producing region of foodstuffs and raw materials in the humid tropical lowlands seems little more than fancy. Do the lands of South America have resources and forces adequate for a rise to the vanguard of nations in this rapidly moving commercial and industrial world of the twentieth century?

CHAPTER II

MAJOR PHYSIOGRAPHIC REGIONS

A comparison of the major physical features of North America and South America reveals several significant characteristics affecting the human geography of the southern continent. Though resembling its northern neighbor in general make-up, at the same time South America shows several broad departures which in some respects are unique among the continents of the world.

On one hand, like North America, it embraces a great western mass of young folded mountains and their associated features, all constituting a tremendous barrier to transportation; in the interior lie vast tropical and temperate lowland plains; on the east a group of plateaus and old worn-down mountains borders the plains, less a barrier than the Andes, but more so than the Appalachians. On the other hand, South America lacks the extensive coastal plains of North America, its continental platform being of reduced width; here have developed no great articulations of land and sea favoring ingress into the continent; the deserts are far smaller than those of Mexico and the United States and among the other continents surpass only those of Europe in size.

In practically every instance of major likeness or difference, the southern lands are less advantageously disposed than North America. Exceeding the Rocky Mountains in height and continuity, the Andes are a far greater obstacle. The interior plains reach their greatest extent in the tropical and largely forested north, the temperate portions forming only a small part of the total area; moreover, the principal agricultural areas have among the poorest natural river facilities, a feature compensated for nevertheless by proximity to the sea. In addition, the eastern highlands rise almost directly from the sea and extend for more than two thousand miles without any considerable natural breach. While certain of these conditions seem striking handicaps, at the same time the elevation of both highland

FIG. 5. PHYSIOGRAPHIC REGIONS

I. The Andes
  1. Southern Andes
  2. Central Andes
    2A. Western Ranges
    2B. Antiplano and Puna de Atacama
    2C. High Pampas of Peru and Ecuador
    2D. Central Ranges of Peru
    2E. Eastern Ranges
  3. Northern Andes
    3A. Western Range
    3B. Central Range
    3C. Eastern Ranges

II. Pacific Valleys and Ranges
  4. Chilean Coastal Range and Chilean Archipelago
  5. Central Valley of Chile
  6. Nitrate and Peruvian Piedmont Pampas
  7. Pacific Plains of Ecuador and Colombia
  8. Colombian Coastal Range

III. The Caribbean Lowlands
  9. Magdalena-Cauca Plains
  10. Maracaibo Lowland

IV. Central Interior Plains
  11. Llanos and Orinoco Delta
  12. Amazon Basin
  13. Paraguay-Paraná Plains
  14. The Pampa

V. Interior Basins and Ranges and the Patagonian Tableland
  15. Interior Basin and Range Lands
  16. Patagonian Tableland

VI. Eastern Highlands
  17. Guiana Highlands and Coastal Plain
  18. Brazilian Highlands
    18A. Interior Plateaus
    18B. São Francisco Basin
    18C. Eastern Plateaus and Ranges

(*Drawn on Goode's Base Map, Sinusoidal Projection.*)

areas in tropical latitudes makes them the most habitable parts of more than half of the South American republics.

THE ANDEAN SYSTEM

The Andes are the most prominent continuous mountain system on the globe. For the entire length of the continent, from the Caribbean Sea to Cape Horn, over more than 4,000 miles, their titanic bulk rears lofty pinnacles to maximum elevations surpassed only by the mountain giants of the Himalayas. In much of their extent, they rise from close to the coast on the west and from the low plains on the east, giving seven per cent of the entire continent an elevation of more than 10,000 feet. This huge mountain mass exerts a potent influence on the soils, climate, vegetation, agriculture, and people of the western part of the continent. Its bold outlines are clearly marked in maps showing agricultural or geographic regions. It is the source of fine fertile soil materials that make garden spots of adjacent valleys and plains. Its elevation accounts for the rains feeding the great rivers of Amazonia, among others; while it serves also as a reservoir for constant supplies of water to feed the thirsty crops of flanking oases. Moreover, its heights produce temperate climates under the tropical sun.

In its major outlines, the system shows three chief divisions, the Southern, Central, and Northern Andes. These differ considerably in relief, elevation, and extent, as well as in influences on human activities (Fig. 5).

Southern Andes.—The comparatively narrow zone of the Andes, which stretches from the southern border of the Puna de Atacama, in latitude 28° S., to the southern extremity of the continent, where it dips beneath the stormy Atlantic waters, is the most compact part of the system. It consists essentially of one main range in which lie both the greatest and least heights of the Andes; in latitude about 36° S. occurs a distinct break in structure and also a transition between the arid Andes of Argentina and the more moist Patagonian Andes, but in respect to general topography the northern and southern sections may be considered as forming the Southern Andes. Between its northern borders and northern Neuquén, the region reaches its greatest elevation, serves as the greatest barrier, and is least habitable (Fig. 6). A good part of the land lies well above

10,000 feet, culminating in volcanic peaks like Mount Aconcagua at 22,812 feet, the highest point in the western hemisphere. Slopes are steep and long. Numerous structural basins exist. Everywhere enormous piles of *talus* have accumulated and, owing to aridity, are removed slowly. In the south the region becomes lower and less continuous. Here glaciation has done considerable work; many glaciers still descend to the sea, giving birth to great icebergs. The

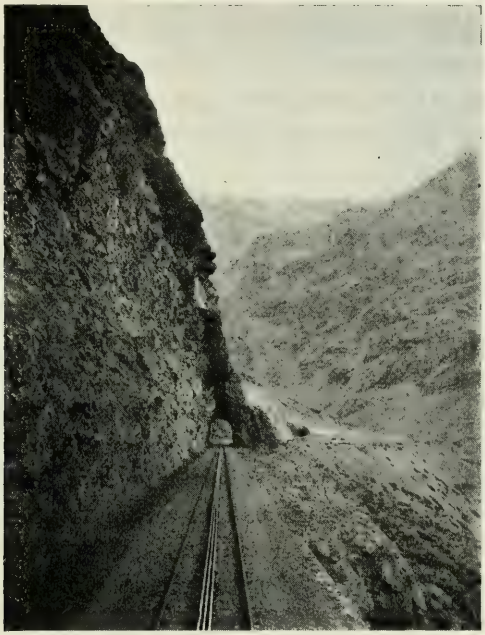

FIG. 6. ALONG THE TRANS-ANDINE, CHILE

For miles on the Chilean side the cog track railway follows an artificial shelf to the side of a high wall and goes through many tunnels and snow sheds in a barren region.

heavier rains, gentler relief, and lower passes make this section far more attractive than the north. Its beautiful lake and mountain scenery has begun to attract tourists, and plans for national parks increase in number as knowledge of the land grows.

Central Andes.—In structure, relief, and human relations, that region of the Andes between northern Argentina and southern Colombia is the most complex portion of the great Western Cordillera. Its chief uniformity lies in its considerable width and elevation; most of the region exceeds 10,000 feet. In the south, two main ranges

inclose the elevated *Altiplano* which averages between 11,000 and 13,500 feet in height. These converge north of Lake Titicaca in the Nudo (knot) de Vilcanota; and northward the region comprises three major mountain ranges, interrupted again by the Nudo de Cerro de Pasco in central Peru and the Nudo de Loja in southern Ecuador, and separated by parts of the Marañon, Huallaga, and Ucayali Valleys. To the north of the last-named knot follows the plateau of Ecuador which lies between two gigantic ranges which merge in southern Colombia in the Nudo de Pasto before splitting into the three main ranges of the Northern Andes. Despite height and ruggedness, the Central Andes produce considerable wealth in agriculture, and they are one of the richest mining regions in the world.

In barest outline, the region falls into five sections: the Western Ranges; the *Altiplano* and Puna de Atacama; the High Pampas of Peru and Ecuador; the Central Range of Peru; and the Eastern Ranges.

The Western Ranges rise steeply from the adjacent coastal mountains and interior plains to elevations almost everywhere surpassing 10,000 feet. They contain some of the grandest volcanic peaks in the world, Chimborazo, Huascarán, and Sajama rising to more than 20,000 feet; they are the greatest barrier to transportation in South America; but they hold enormous mineral resources. The *Altiplano* of Bolivia, with which is associated the Puna de Atacama, is a vast intermontane plateau, or system of plateaus, of gentle to rolling relief, and largely of interior drainage. In the south, it contains extensive salt plains; but about Lake Titicaca, the huge fresh-water lake which lies at an elevation of 12,508 feet, the tremendous accumulations of relatively unconsolidated materials are capped by more favorable soils (Fig. 7). Between the knots of Vilcanota and Pasto are a number of minor plateau areas, known as the High Pampas of Peru and Ecuador. They consist of inter-range depressions in which lie thick deposits of material washed from the mountains; these deposits, largely volcanic, give rise to soils of great fertility, so that these zones foster some of the principal agricultural districts of the highlands. Consisting of two disconnected portions separated by the Nudo de Cerro de Pasco, the Central Range of Peru, though not so formidable as the Western Ranges, interposes a second stu-

pendous barrier to travel. On its western flanks are huge mineral deposits. In certain parts the Eastern Ranges offer some of the most impressive mountain scenery in the world, the Cordillera Real of Bolivia, for example, averaging 20,000 feet in height over a length of nearly 100 miles. On the whole, however, they are far less continuous or forbidding in aspect than the Western Ranges. In the long, though fairly steep, slopes to the interior plains, they shelter the rich agriculture of regions like the Yungas; in minerals, they vie with the other ranges, but only in Bolivia and southern Peru;

FIG. 7. THE "ALTIPLANO" SOUTH OF LAKE TITICACA

This gently sloping piedmont plain, with a stony loose soil, low in humus, lies in the chief agricultural section of the Bolivian Highland. Rows of Irish potatoes; piles of stones in the middle distance; the Eastern Cordillera in the distance.

the northern sections in Peru and Ecuador lack important mineralized areas.

Northern Andes.—As regards habitability, the Northern Andes are the most favorably located region of the system. To Colombia and Venezuela, which otherwise have only the hot pestiferous lowlands, they represent a boon of incalculable value. As a whole, they least hinder communications, for although high they extend parallel to the main direction of commerce in Colombia and lie near the coast in Venezuela. In addition, though not in such quantities as in the Central Andes, they have important mineral deposits and harbor the chief concentrations of population of northern South America. In

general, they include three major subdivisions and their neighboring features: the Cordilleras Occidental, Central, and Oriental or Western, Central, and Eastern Ranges, respectively. Of these the Western and Central Ranges are well defined in make-up, but the Eastern

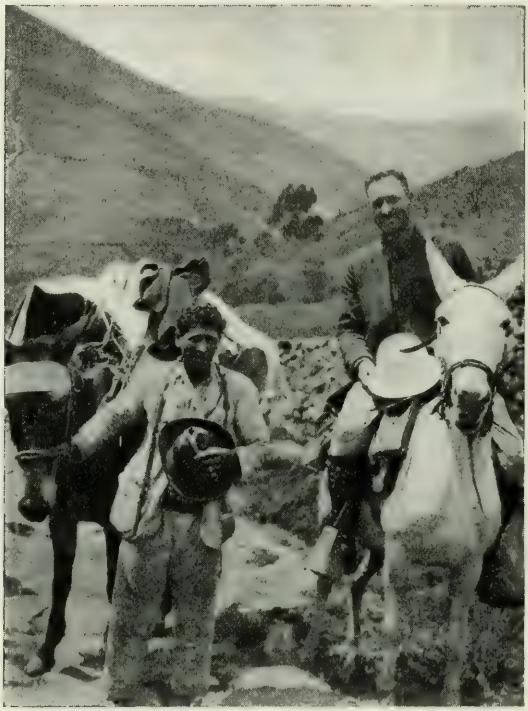

FIG. 8. THE EASTERN CORDILLERA, BOYACÁ, COLOMBIA

The author and his guide four days by mule-back north of Bogotá. Much of Highland Colombia consists of young rugged mountains. Wheat fields on the slope in the distance.

Ranges have a complicated nature and in reality embrace several distinct parts.

The Western Range is the lowest of the three, having a general altitude above sea level of between 8,000 and 9,000 feet. At its northern terminus it sinks gradually into the foothills which interrupt the surface of the Sinú-Cauca Plains. For much of its length it is cut off from the Pacific by the Valley of the Atrato River and by a low coastal range.

Eastward and separated from the Western Range by the long Cauca Valley, the Central Range is the highest large mountainous area of the Northern Andes. For most of its extent, it exceeds 10,000 feet; the volcanic mountains Purace, Huila, and Tolima reach 18,000 feet. At the north it widens out into a much lower zone which is one of the richest agricultural areas of Colombia.

In the national economy of both Colombia and Venezuela, the Eastern Ranges have outstanding importance. In both cases they contain the principal groups of population. Some of their parts, nevertheless, are among the least developed of their countries, owing in large part to their rugged nature. In the south the Cordillera Oriental extends from Ecuador almost to Bogotá in one main range standing out in striking contrast to the Magdalena Valley and the eastern lowlands. South of Bogotá the highland broadens and extends northeast as a number of parallel ranges, between which are high savannas, level basin areas, between 8,200 and 8,600 feet above sea level (Fig. 8). Near the international border the Cordillera Oriental divides, the Sierra de Perijá extending northward in a series of parallel ranges and the Sierra Nevada de Mérida eastward. Succeeding the Sierra de Perijá at the north are the high Sierra Nevada de Santa Marta and the low ridges of the Goajira Peninsula. In Venezuela the towering peaks and ranges of the Sierra Nevada de Mérida give way to the subdued Segovia Highlands, the northern Ranges of Venezuela and Trinidad and to the fertile Lake Valencia Basin.

THE PACIFIC COAST

The physiographic features lying between the sea and the Andes show many forms analogous to those of the Pacific lands of North America. The succession of sections from north to south closely resembles that from Central America to southern Alaska.

Chilean Coastal Ranges and Chilean Archipelago.—Progressively less continuous from north to south, the Chilean Coastal Ranges extend virtually from the northern border of the country to its southern extremity, where for several hundred miles they break into the fragments which constitute the Chilean Archipelago. Between latitudes 23° S. and 33° S. they comprise several transverse Andean spurs and valleys, but elsewhere their linear form is distinct. Rising abruptly from a sea of great depth near shore, these mountains are

a considerable obstacle but in general they nowhere exceed 7,500 feet, averaging far higher in north and south than in the central portions; and south of latitude 33° S. they are broken by broad lowland areas. The numerous islands studding the sea south of Puerto Montt suggest the Alaskan Archipelago, while northward the mountains border a zone very much like the Puget Trough of Washington.

Central Valley of Chile.—South of latitude 33° S. the Central Valley of Chile constitutes an alluvium-filled trough receiving sediments from the low coastal mountains and the lofty Andes. Rather narrow at the north, it widens southward into a plain having a width of from 30 to 60 miles. Over most of its extent, the valley lies between 300 and 1,000 feet above the sea. As is the case in the Valley of California, the compound piedmont plains give much of its area a surface not to be thought of as uniformly level. Also like parts of California, its position at the foot of the Andes and near a deep sea makes the land exceedingly unstable. Earthquakes from time to time have taken heavy toll of life in this most densely populated of Chilean regions.

Nitrate and Peruvian Piedmont Pampas.—In Chile this region consists chiefly of interior plains, formed by detritus from the Andes and the Coastal Ranges and kept comparatively intact by the aridity which has favored preservation of the enormous reserves of sodium nitrate. Generally, they lie at elevations between 3,000 and 6,000 feet. Roughly speaking, this area is a northern counterpart of the Central Valley, its character in this respect showing most clearly in the Pampa de Tamarugal, a broad plateau, and in the Atacama Desert.

In Peru the intermontane character is gone; numerous low spurs transverse to the Andes separated by the irrigated fertile valleys form the Peruvian Piedmont Pampa, or essentially the Peruvian Coastal Desert. About Mollendo the mountains near the coast attain 4,000 feet and the interior pampa almost 6,500 feet. Northward the coastal mountains become lower, in many places comprising mere hills, and at the northern borders of Peru, the zone grades into the narrow coastal plain.

Pacific Plains of Ecuador and Colombia.—In major topographic aspect this region is a plain gently sloping from the Andes to the sea. Here and there, however, particularly in the southwest, mountain masses reaching an elevation of 3,000 feet rise above the general

surface. In the far south the zone of plain is practically non-existent, the Andes extending out to the sea, but farther north it reaches a maximum width of 140 miles. The broad, swampy, alluvium-filled valley of the Guayas River is a prominent feature.

Colombian Coastal Range.—Separating the former thoroughfare, formed by the broad alluvial valleys of the San Juan and Atrato Rivers between the Pacific and Atlantic Oceans, from the sea the Coastal Range of Colombia or Sierra de Baudo is one of the least

FIG. 9. A DRAINAGE DITCH, RIO FUNDACIÓN, COLOMBIA

Opening a drainage ditch in the sandy loam soils of the piedmont plain to the west of the Sierra Nevada de Santa Marta, a part of the great Magdalena Cauca Lowland.

conspicuous and least known of the South American mountain units. Its greatest elevation is 6,000 feet.

CARIBBEAN LOWLANDS

Between the Andean ranges and the Caribbean Sea lie two distinct lowland areas, one of which—the Magdalena-Cauca Plains—owes its origin to voluminous river deposits, while the other—the Maracaibo Basin—is a true structural basin as yet unfilled and almost inclosed by highlands.

Magdalena-Cauca Plains.—Much of the land in the region lies in a basin similar to that of Maracaibo. Here the rivers descending heavily laden with Andean sediment have constructed a sort of interior delta of periodically inundated flat lands (Fig. 9). To the west

of the lower Magdalena lies a patch of higher solid land, rising to 1,000 feet; this serves to give the area some of its basin-like character, as have also the Sierra Nevada de Santa Marta and the Sierra de Perijá.

Maracaibo Basin.—This region lies almost completely shut in by the Sierra de Perijá, the ranges of the Goajira Peninsula, the Segovia Highlands, and the Sierra Nevada de Mérida. Like the plains of the great rivers of Colombia, the basin has much new land forming but as yet a large part of its area lies under the brackish waters of Lake Maracaibo. Its margins likewise are recurrently flooded and swampy, but have exceedingly fertile soils.

CENTRAL INTERIOR PLAINS

Composing fully one-half of South America's area, the expansive plains lying between the great Andean backbone and the two detached portions of the Eastern Highlands constitute a zone of land almost wholly under 1,000 feet in elevation extending from the Caribbean Sea to the Rio Colorado in Argentina. As yet, owing to their reduced elevation in low latitudes, they hold only a relatively small number of the continent's population. For the future, however, large parts of the great stretches of river and wind deposited materials constitute lands that will have considerable populations.

Most of the plain's area consists of gently rolling land, the undulations in some parts being almost imperceptible. The regions of the north—the Llanos, Amazon Basin, and Paraguay-Paraná Plains —consisting of recent marine sediments have been mantled with alluvium from the various great rivers coming from the Andes. In the south, the Pampa of unconsolidated sediments has received tremendous accumulations of wind-blown materials.

Llanos and Orinoco Delta.—Hardly anywhere do these plains exceed an elevation of 800 feet (Fig. 10). Their smooth surfaces extend from Rio Guaviare to the Atlantic, with only small areas of old hills or of more recent sand dunes breaking the continuity of the loose sediments brought from the Andes by the voluminous tributaries of the Orinoco River. Owing to the gentle gradient, rainy season floods inundate much of the region and bring additional materials to be deposited. At the outlet to the plains lies the rapidly growing low swampy delta of the Orinoco.

Amazon Basin.—Under the influences of high humidity and temperature, the basin of the Amazon has amassed tremendous deposits of silts, clays and fine sands. At a distance of 2,000 miles from the sea the altitude of the plain is less than 350 feet. Throughout the year, in one part of the basin or another, the powerful streams bring down prodigious loads which are spread over considerable areas during high water stages. Though low and flat over vast districts

FIG. 10. SAVANNA VEGETATION IN THE NORTHERN LLANOS

Most of the Llanos supports tall bunch grasses; in the picture the foreground has been well grazed; along the major stream courses are rather dense growths of gallery forests. (*Courtesy of Ernest G. Holt.*)

many interstream portions possess fairly well-drained areas—*tierra firma*.

Paraguay-Paraná Plains.—Separated from the Amazon Basin by a low divide—elevation less than 1,000 feet—in Matto Grosso, the plains of the Paraguay and Paraná Rivers encompass an extent from the watershed to the Rio de la Plata of some 1,500 miles. Though in respect to degree of relief they resemble the Amazon region, they exhibit broad differences. While the Paraguay and Paraná are among the great rivers of the world, here exists no system at all comparable to that lying to the north. Indeed great areas to the west of the Paraguay River have no visible drainage courses and are simply extensive featureless plains with broad swamps for part of the year.

Pampa.—Among the physical regions of South America, the Pampa is distinctive in mode of origin, relief, and drainage, as well as in its unmatched agricultural development (Fig. 11). Its hundreds of feet of fine unconsolidated soil materials covered with a deep mantle of loess, are unique in South America. So uniformly has the thick mantle of materials been spread, that only the gentlest swells disturb the surface of most of the far-reaching plain. The region is remarkably deficient in stream drainage, only one stream crossing the Pampa from the west in its whole north-south extent of nearly 1,000

FIG. 11. THE PAMPA, BALCARCE

The level fertile Pampa, of little utility a century ago, is the chief surplus food and raw industrial materials region of the world. (*Courtesy of the Buenos Aires Great Southern Railway.*)

miles; hundreds of small ponds dot the landscape. Except in the small patches about the Sierras de Tandil and de la Vantana, none of the Pampa has an altitude of 1,000 feet above the sea.

INTERIOR BASINS AND RANGES AND THE PATAGONIAN TABLELAND

Most of western Argentina and a small area in Southern Bolivia are embraced in one major physiographic division, the principal unity of which lies in its great dissimilarities to any other part of South America.

Interior Basins and Ranges.—In many ways, this region corresponds to the Basin and Range lands of North America. Here in a similarly arid land lie numerous isolated ranges, surrounded by basins generally of tectonic origin and which have received huge quantities of debris

from the mountainous areas to form the fertile piedmont plains. Some of the ranges, like the Pre-Cordilleras of Mendoza and San Juan, are separated from the main Andean chain only by relatively narrow longitudinal basins. The inner ranges rise more than 16,000 feet in elevation, the comparatively detached Sierra de Córdoba 6,000 feet. Interior drainage is the rule, to which widespread saline deposits bear witness.

Patagonian Tableland.—Rising to a maximum elevation of 5,000 feet, the Patagonian Tablelands are bordered by lowlands on both east and west. To the east lie the narrow coastal plains, to the west the longitudinal depression separating the Southern Andes and the plateau. Large areas of sandstone and crystalline plateaus in the north and recent lava flows in the east are flat deserts swept by howling winds and deeply gashed by the narrow canyons of the several transverse rivers. Southward, the altitude decreases, rains are heavier, and the land becomes far more hospitable. Like the region of Interior Basins and Ranges, the Patagonian Tableland shows interior drainage, though only in the north.

EASTERN HIGHLANDS

The far-flung reaches of the ancient mountains and newer plateaus which compose the Eastern Highlands are among the least known divisions of South America. This is due largely to structural features which have hindered access to the interior, such as the long Serra do Mar, which rises almost directly from the waters of the Atlantic. Responsible also for this situation is the nature of the climate prevailing over most of the area, and the lack of important navigable streams facilitating communications.

Guiana Highlands and Coastal Plain.—Much of this region constitutes an absolute *terra incognita* so far as exact geographical data are concerned. Such lack of knowledge well reflects the inaccessible character of most of the land. The highland portion proper contains the remnants of ancient mountains as well as more recent plateaus, the highest lands lying in the northwest where Mount Icutu reaches 11,000 feet and on the southern borders where the Serra Parima and the Serra Pacaraima overlook the Amazon Basin. Deeply incised valleys have broken most of the region into a confusion of features.

Between the delta of the Orinoco and the mouth of the Amazon,

the large streams draining the eastern Guiana Highlands have built much of the coastal plain on which lie the agricultural sections of the Guiana Colonies. It is here that the continent's coastal plains reach their greatest width. Low and flat, much of the cultivated area has been reclaimed from the sea; some lies on the rapidly growing islands formed at the mouths of the rivers.

Brazilian Highlands.—In this vast mass of mountain and plateau lies Brazil of today. A huge expanse of land, largely over 2,000 feet

FIG. 12. THE BRAZILIAN HIGHLANDS

The rolling plateau of eastern Brazil, the second great productive region of the continent; Buenopolis, Minas Geraes, nestled in the valley in the foreground; in the distance the even sky line marks the old erosion surface. (*Courtesy of Ernest G. Holt.*)

above the sea, makes possible the dense peopling of large areas in tropical latitudes. Towards the Amazon Basin, it embraces the level-topped, though deeply stream-cut, plateaus of Matto Grosso, bordered on the east by several ridges in some places reaching an elevation of 5,000 feet (Fig. 12). In the northeast, between the coastal mountains and the Matto Grosso-Goyaz uplands lies the extensive basin of the São Francisco River, an area comprising broad level platforms, and almost entirely surrounded by mountain ridges. North of this is the peneplained crystalline area of Northeast Brazil, above which rise a number of low mountainous areas of limited extent. In the southeast lie the Eastern Plateaus and Ranges, a region of mountain and plateau of great agricultural, forestal, and mineral wealth. A

considerable part is a rolling upland with the major slope towards the west. On the east the land falls to the sea in the precipitous slopes of the Serra do Mar, which in Mount Itatiaya attains a maximum elevation of almost 9,000 feet. In Minas Geraes, the region consists of a complicated zone showing broad peneplained plateau-like areas as well as the lofty Serras do Espinhaço, and do Matta da Corda. Here and there along the seaward margin of the Highlands lie narrow strips of coastal plain; these are broadest in the northeast.

HUMAN RESPONSES TO THE MAJOR PHYSIOGRAPHIC FEATURES

Contrary to a principle effective in the most populous lands of the world, namely that population concentrates in the lowlands, South America shows most of its people in the highlands. Here climatic conditions make the lowland plains the least populated parts of the continent, only four of the republics having most of their people on such land. For most of the continent, this situation will long prevail because of the unfavorable climates of certain lowland areas, their remoteness, and the striking habitability of various highland regions, such as, for example, the immensely productive central plateau of eastern Brazil.

In the case of its effects upon the distribution of population, the significance of continental form is clear. No less striking are the innumerable influences on every phase of the physical and human geography of South America. In the last analysis, a consideration of the smallest geographic unit must involve reference to the great mass of the Andes on the west, to that of the Eastern Highlands on the east, and to the great sweep of Central Interior Plains.

CHAPTER III

CLIMATES

The continent of South America has the unenviable distinction of having the greatest continental expanse with a rainy tropical climate. Those lands favoring human settlement, on the other hand, taper rapidly south of the Tropic of Capricorn. In these respects, South America is inferior to North America, Europe, or Asia as a scene of settlement, but as compared to the other continents lying wholly or partially in the southern hemispheres its characteristics are considerably enhanced in attractiveness. Though it does have most of its area north of latitude 23½° S., at the same time the lands south of that parallel have no inconsiderable extent. Moreover, its stretch from 8° N. to 55° S. gives South America a great range of climates tending to promote inter-regional exchange of a variety of products. This feature is greatly augmented by the mountainous region.

The tapering of the southern lands explains various significant relationships in the geography of the continent. Owing to the limited expanse of land in the higher latitudes and the pronounced influence of the sea, the bitter cold and burning heat of continental interiors like those of "temperate" North America and Eurasia are not so evident.

Its mountains further modify the climatic situation in South America. The presence of the lofty Andes in tropical latitudes is a paramount consideration in the geography of most countries. Because of the mountains arose the early dominance of the highland peoples in South America. There men found relief from the heat of a high sun despite their latitude. The plateaus and mountains of Brazil have exercised a similar beneficial influence.

In contrast to the favoring great height of the mountains is the uniformly low elevation of the vast interior plains. Lying at an altitude of less than 500 feet above the sea at a distance 2,000 miles inland, the great Amazonian plains give full reign to the play of a burning sun and an elevated relative humidity favored by the lack of marked barriers in the paths of wet winds from the Atlantic on both sides of the Equator.

As regards the effects of prevailing winds, with which are bound up the conditions of latitudes, South America once more shows inferiority to northern hemisphere continents and superiority to other lands in the southern hemisphere. Owing to the height of the Andes and the small areas in high latitudes, the prevailing westerlies which bring so many benefits to Europe and North America here have little importance. On the other hand, the trade winds which cause the parched deserts of Africa and Australia here affect most of their zone in a far different way, their persistence and convergence in Amazonia giving that region its downpours. Additional sources of rainy winds for parts of the continent lie in the northeasterly winds blowing from the same high pressure area of the South Atlantic whence come the southeasterly trades.

Ocean currents about the coasts of South America have peculiar and striking importance. On the west coast from central Chile to Northern Peru, the cold Humboldt Current exercises a profound climatic influence, owing to the cooling of winds passing over its waters. Its significance is well borne out in the presence of the west coast desert, where such soluble substances as nitrates and guano have been preserved for centuries. Similar effects are produced in other parts of the continent by upwelling cold waters near the shore: notable among these are the northeast coast of Brazil and the Caribbean coasts. Warm currents, like those skirting northeast and southeast Brazil and such on the West Coast as the Niño, which in shifting may give heavy rains to the desert, act in a less noticeable way but they explain the rains of many lands.

A final factor of considerable importance in the climate of parts of South America is that of the succession of cyclones and anticyclones. Owing to the frequency and intensity of storms in the far south, the waters about the Strait of Magellan and off the Chilean Archipelago are among the roughest on the globe. These are genuine "roaring forties." Northward over the Pampa the cyclonic control of weather also is well marked.

THE CLIMATES

The interrelations of the seven climatic controls—latitude, land and water bodies, mountain barriers, altitude, prevailing winds, ocean currents, and storms—produce in South America fourteen areas possessing a certain uniformity of climatic conditions. Each of these may

be designated a climatic type or, more simply, a climate. Following are the names of the types, their locations, and characteristic climate records.[1]

I. Rainy high latitude; the far southern Andes, southern Patagonia, and the Falkland Islands; Puerto Gallegos (IA 1), Magallanes (IA 2), Evanjelistas (IB 3), Puerto Montt (IB 4).[2]

II. Mediterranean; Middle Chile; Santiago (II 5), Coquimbo (II 6).

III. West Coast desert; coastal Peru and northern Chile; Iquique (III 7), Lima (III 8).

IV. Interior desert; western and southern Argentina, southwestern Bolivia; San Juan (IV 9).

V. East coast temperate; the Pampa, Entre Rios country, Uruguay, and southern Brazil; Rio Cuarto (V 10), Rosario (V 11).

VI. Subtropical highlands; central plateau of eastern Brazil; Rio Grande do Sul (VI 12), Curityba (VI 13), São Paulo (VI 14).

VII. Rainy trade wind coasts; east coast Brazil from near Santos to north of Pernambuco; Rio de Janeiro (VII 15), Bahia (VII 16), Pernambuco (VII 17).

VIII. Semi-arid trade-wind interior; northeast Brazil; Quixeranobim (VIII 18).

IX. Southern hemisphere savannas; the Campos, the Chaco; Morro do Chapeo (IX 19), Asunción (IX 20), Cuyabá (IX 21).

X. Northern hemisphere savannas; the Llanos, Bolívar savannas; Calabozo (X 22).

XI. East coast equatorial lowlands; Amazonia, Guiana littoral; Iquitos (XI 23), Manáos (XI 24), Pará (XI 25), Georgetown (XI 26), Port of Spain (XI 27).

XII. West coast equatorial lowlands; western Ecuador and Colombia; Guayaquil (XII 28), Andagoya (XII 29).

XIII. Semi-arid trade-wind coasts; coastal Colombia and Venezuela; Cartagena (XIII 30), Maracaibo (XIII 31).

XIV. Low latitude highlands; northern Andes, northern and eastern sections of central Andes; Bogotá (XIV 32), Quito (XIV 33), La Paz (XIV 34), Cochabamba (XIV 35), La Quiaca (XIV 36) (Figs. 13, 14, 15 and 16).

[1] Owing to the paucity of available climatic data, it has not been thought advisable to construct a map with definite boundaries, showing the climatic regions of the continent.

[2] Numerals and letters refer to charts accompanying text.

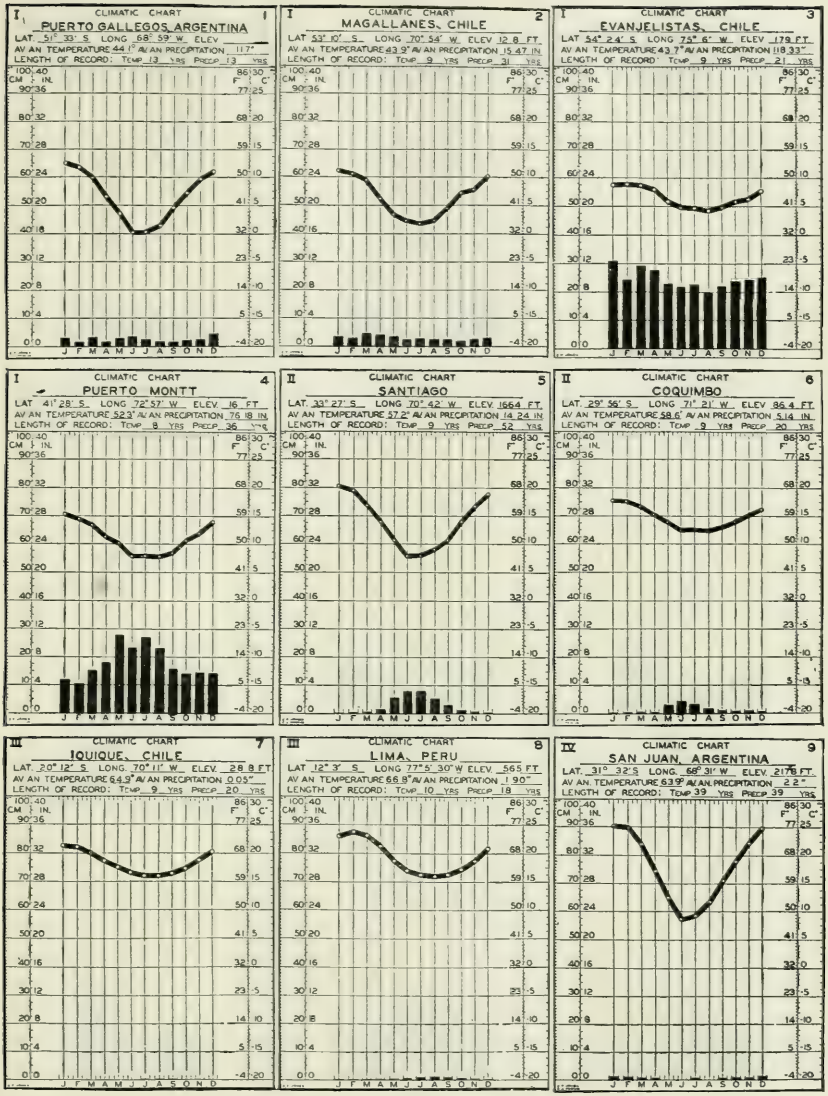
I CLIMATIC CHART 1
PUERTO GALLEGOS, ARGENTINA
LAT. 51° 33' S. LONG. 68° 59' W. ELEV.
AV. AN. TEMPERATURE 44.1° AV. AN. PRECIPITATION 11.7"
LENGTH OF RECORD: TEMP. 13 YRS. PRECIP. 13 YRS.
I CLIMATIC CHART 2
MAGALLANES, CHILE
LAT. 53° 10' S. LONG. 70° 54' W. ELEV. 12.8 FT.
AV. AN. TEMPERATURE 43.9° AV. AN. PRECIPITATION 15.47 IN.
LENGTH OF RECORD: TEMP. 9 YRS. PRECIP. 31 YRS.
I CLIMATIC CHART 3
EVANJELISTAS, CHILE
LAT. 54° 24' S. LONG. 75° 6' W. ELEV. 179 FT.
AV. AN. TEMPERATURE 43.7° AV. AN. PRECIPITATION 118.33"
LENGTH OF RECORD: TEMP. 9 YRS. PRECIP. 21 YRS.
I CLIMATIC CHART 4
PUERTO MONTT
LAT. 41° 28' S. LONG. 72° 57' W. ELEV. 16 FT.
AV. AN. TEMPERATURE 52.3° AV. AN. PRECIPITATION 76.18 IN.
LENGTH OF RECORD: TEMP. 8 YRS. PRECIP. 36 YRS.
II CLIMATIC CHART 5
SANTIAGO
LAT. 33° 27' S. LONG. 70° 42' W. ELEV. 1664 FT.
AV. AN. TEMPERATURE 57.2° AV. AN. PRECIPITATION 14.24 IN.
LENGTH OF RECORD: TEMP. 9 YRS. PRECIP. 52 YRS.
II CLIMATIC CHART 6
COQUIMBO
LAT. 29° 56' S. LONG. 71° 21' W. ELEV. 86.4 FT.
AV. AN. TEMPERATURE 58.6° AV. AN. PRECIPITATION 5.14 IN.
LENGTH OF RECORD: TEMP. 9 YRS. PRECIP. 20 YRS.
III CLIMATIC CHART 7
IQUIQUE, CHILE
LAT. 20° 12' S. LONG. 70° 11' W. ELEV. 28.8 FT.
AV. AN. TEMPERATURE 64.9° AV. AN. PRECIPITATION 0.05"
LENGTH OF RECORD: TEMP. 9 YRS. PRECIP. 20 YRS.
III CLIMATIC CHART 8
LIMA, PERU
LAT. 12° 3' S. LONG. 77° 5' 30" W. ELEV. 565 FT.
AV. AN. TEMPERATURE 66.8° AV. AN. PRECIPITATION 1.90"
LENGTH OF RECORD: TEMP. 10 YRS. PRECIP. 18 YRS.
IV CLIMATIC CHART 9
SAN JUAN, ARGENTINA
LAT. 31° 32' S. LONG. 68° 31' W. ELEV. 2176 FT.
AV. AN. TEMPERATURE 63.9° AV. AN. PRECIPITATION 2.2"
LENGTH OF RECORD: TEMP. 39 YRS. PRECIP. 39 YRS.
CM. IN. F° C°
J F M A M J J A S O N D

FIG. 13. CLIMATIC CHARTS

Of what significance is the distribution of precipitation shown in the first four stations?

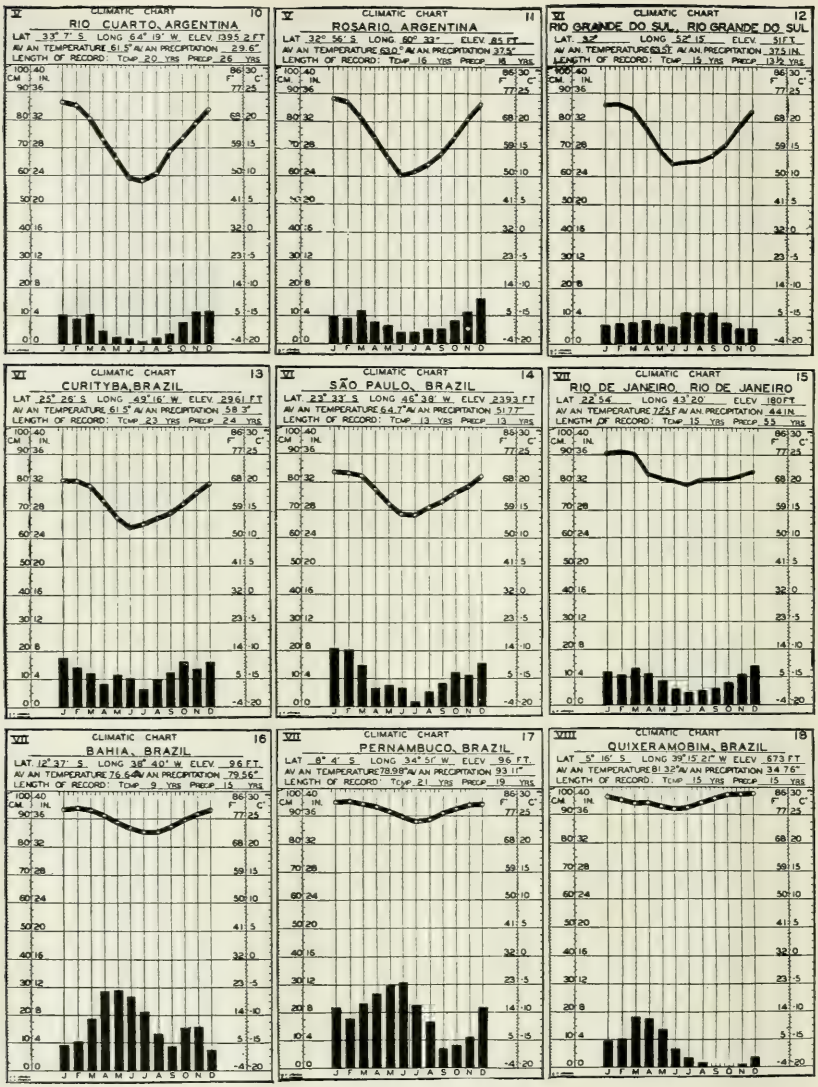

FIG. 14. CLIMATIC CHARTS

Give the relationship of the season of low rainfall in charts 10 and 14 to the production of the chief crops.

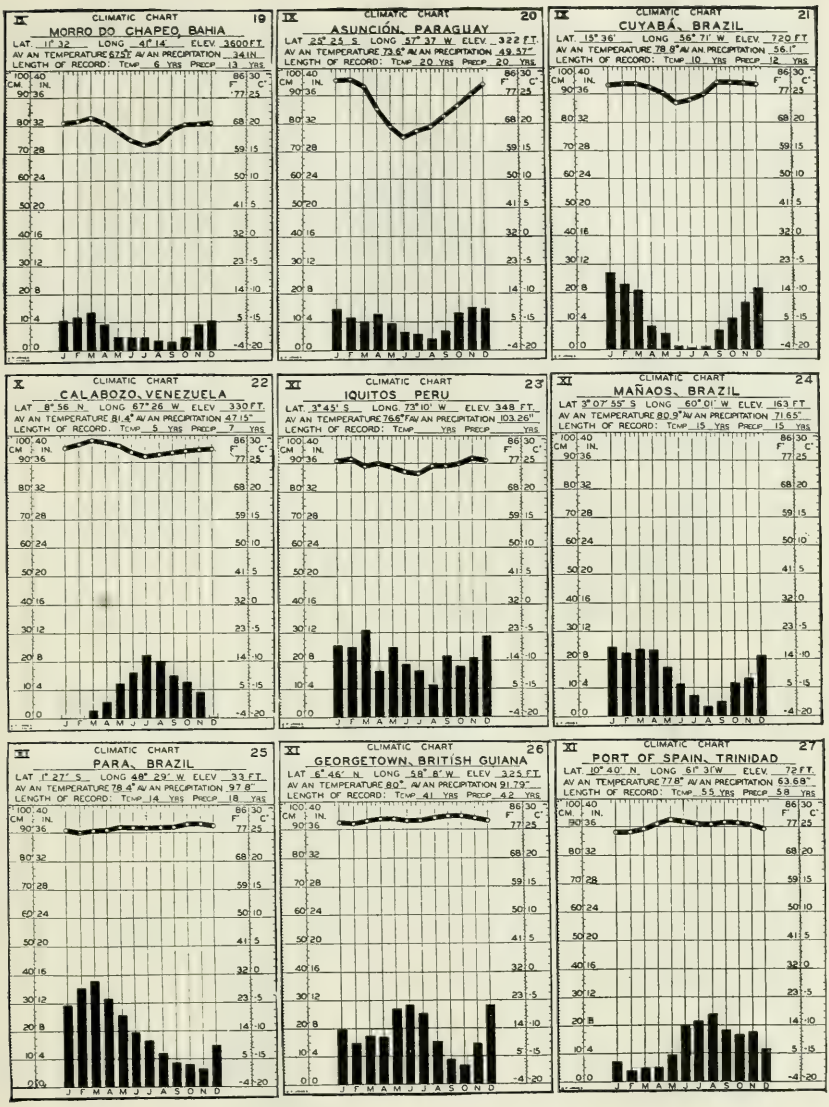
CLIMATIC CHART 19
MORRO DO CHAPEO, BAHIA
LAT. 11° 32' LONG. 41° 14' ELEV. 3600 FT.
AV. AN. TEMPERATURE 67.5° AV. AN. PRECIPITATION 34 IN.
LENGTH OF RECORD: TEMP. 6 YRS PRECIP. 13 YRS
CLIMATIC CHART 20
ASUNCIÓN, PARAGUAY
LAT. 25° 23' S. LONG. 57° 37' W. ELEV. 322 FT.
AV. AN. TEMPERATURE 73.6° AV. AN. PRECIPITATION 49.57"
LENGTH OF RECORD: TEMP. 20 YRS PRECIP. 20 YRS
CLIMATIC CHART 21
CUYABÁ, BRAZIL
LAT. 15° 36' LONG. 56° 7' W. ELEV. 720 FT.
AV. AN. TEMPERATURE 78.8° AV. AN. PRECIPITATION 56.1"
LENGTH OF RECORD: TEMP. 10 YRS PRECIP. 12 YRS
CLIMATIC CHART 22
CALABOZO, VENEZUELA
LAT. 8° 56' N. LONG. 67° 26' W. ELEV. 330 FT.
AV. AN. TEMPERATURE 81.4° AV. AN. PRECIPITATION 47.15"
LENGTH OF RECORD: TEMP. 5 YRS PRECIP. 7 YRS
CLIMATIC CHART 23
IQUITOS PERU
LAT. 3° 45' S. LONG. 73° 10' W. ELEV. 348 FT.
AV. AN. TEMPERATURE 76.6° AV. AN. PRECIPITATION 103.26"
LENGTH OF RECORD: TEMP. YRS PRECIP. YRS
CLIMATIC CHART 24
MAÑAOS, BRAZIL
LAT. 3° 07' 55" S. LONG. 60° 01' W. ELEV. 163 FT.
AV. AN. TEMPERATURE 80.9° AV. AN. PRECIPITATION 71.65"
LENGTH OF RECORD: TEMP. 15 YRS PRECIP. 15 YRS
CLIMATIC CHART 25
PARA, BRAZIL
LAT. 1° 27' S. LONG. 48° 29' W. ELEV. 33 FT.
AV. AN. TEMPERATURE 78.4° AV. AN. PRECIPITATION 97.8"
LENGTH OF RECORD: TEMP. 14 YRS PRECIP. 18 YRS
CLIMATIC CHART 26
GEORGETOWN, BRITISH GUIANA
LAT. 6° 46' N. LONG. 58° 8' W. ELEV. 325 FT.
AV. AN. TEMPERATURE 80°. AV. AN. PRECIPITATION 91.79"
LENGTH OF RECORD: TEMP. 41 YRS PRECIP. 42 YRS
CLIMATIC CHART 27
PORT OF SPAIN, TRINIDAD
LAT. 10° 40' N. LONG. 61° 31' W. ELEV. 72 FT.
AV. AN. TEMPERATURE 77.8° AV. AN. PRECIPITATION 63.68"
LENGTH OF RECORD: TEMP. 55 YRS PRECIP. 58 YRS
CM. IN. F° C°
J F M A M J J A S O N D

FIG. 15. CLIMATIC CHARTS

Explain the temperature curves shown on charts 8, 9, 13, 15, 34 and 35.

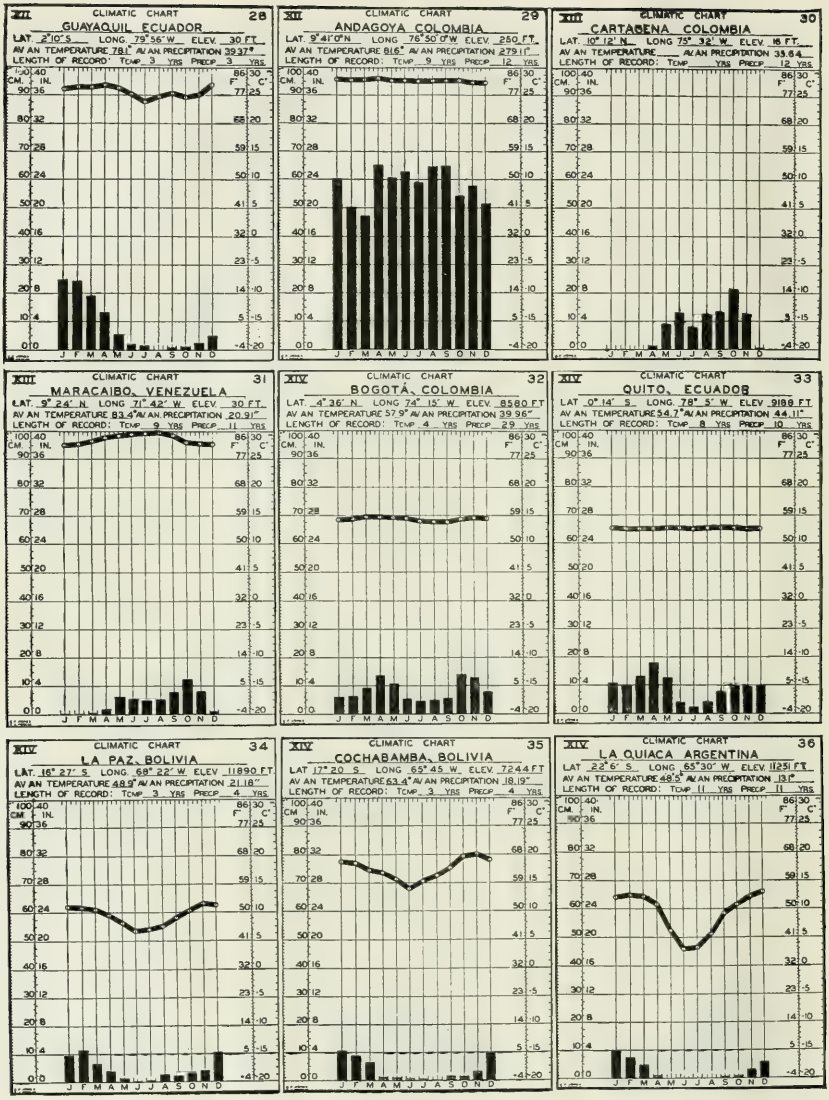
CLIMATIC CHART 28
GUAYAQUIL ECUADOR
LAT. 2° 10' S. LONG. 79° 56' W. ELEV. 30 FT.
AV AN TEMPERATURE 78.1° AV AN PRECIPITATION 39.37"
LENGTH OF RECORD: TEMP. 3 YRS PRECIP. 3 YRS
CLIMATIC CHART 29
ANDAGOYA COLOMBIA
LAT. 9° 41' 0" N. LONG. 76° 30' 0" W. ELEV. 250 FT.
AV AN TEMPERATURE 81.6° AV AN PRECIPITATION 279.1"
LENGTH OF RECORD: TEMP. 9 YRS PRECIP. 12 YRS
CLIMATIC CHART 30
CARTAGENA COLOMBIA
LAT. 10° 12' N. LONG. 75° 32' W. ELEV. 16 FT.
AV AN TEMPERATURE AV AN PRECIPITATION 38.64
LENGTH OF RECORD: TEMP. YRS PRECIP. 12 YRS
CLIMATIC CHART 31
MARACAIBO, VENEZUELA
LAT. 9° 24' N. LONG. 71° 42' W. ELEV. 30 FT.
AV AN TEMPERATURE 83.4° AV AN PRECIPITATION 20.91"
LENGTH OF RECORD: TEMP. 9 YRS PRECIP. 11 YRS
CLIMATIC CHART 32
BOGOTÁ, COLOMBIA
LAT. 4° 36' N. LONG. 74° 15' W. ELEV. 8580 FT
AV AN TEMPERATURE 57.9° AV AN PRECIPITATION 39.96"
LENGTH OF RECORD: TEMP. 4 YRS PRECIP. 29 YRS
CLIMATIC CHART 33
QUITO, ECUADOR
LAT. 0° 14' S. LONG. 78° 5' W. ELEV. 9188 FT
AV AN TEMPERATURE 54.7° AV AN PRECIPITATION 44.11"
LENGTH OF RECORD: TEMP. 8 YRS PRECIP. 10 YRS
CLIMATIC CHART 34
LA PAZ, BOLIVIA
LAT. 16° 27' S. LONG. 68° 22' W. ELEV. 11890 FT.
AV AN TEMPERATURE 48.9° AV AN PRECIPITATION 21.18"
LENGTH OF RECORD: TEMP. 3 YRS PRECIP. 4 YRS
CLIMATIC CHART 35
COCHABAMBA, BOLIVIA
LAT. 17° 20' S. LONG. 65° 45' W. ELEV. 7244 FT
AV AN TEMPERATURE 63.4° AV AN PRECIPITATION 18.19"
LENGTH OF RECORD: TEMP. 3 YRS PRECIP. 4 YRS
CLIMATIC CHART 36
LA QUIACA ARGENTINA
LAT. 22° 6' S. LONG. 65° 30' W. ELEV. 11251 FT.
AV AN TEMPERATURE 48.5° AV AN PRECIPITATION 13.1"
LENGTH OF RECORD: TEMP. 11 YRS PRECIP. 11 YRS
J F M A M J J A S O N D

FIG. 16. CLIMATIC CHARTS

Explain the precipitation curve shown on charts 24, 25, 28, 29 and 32.

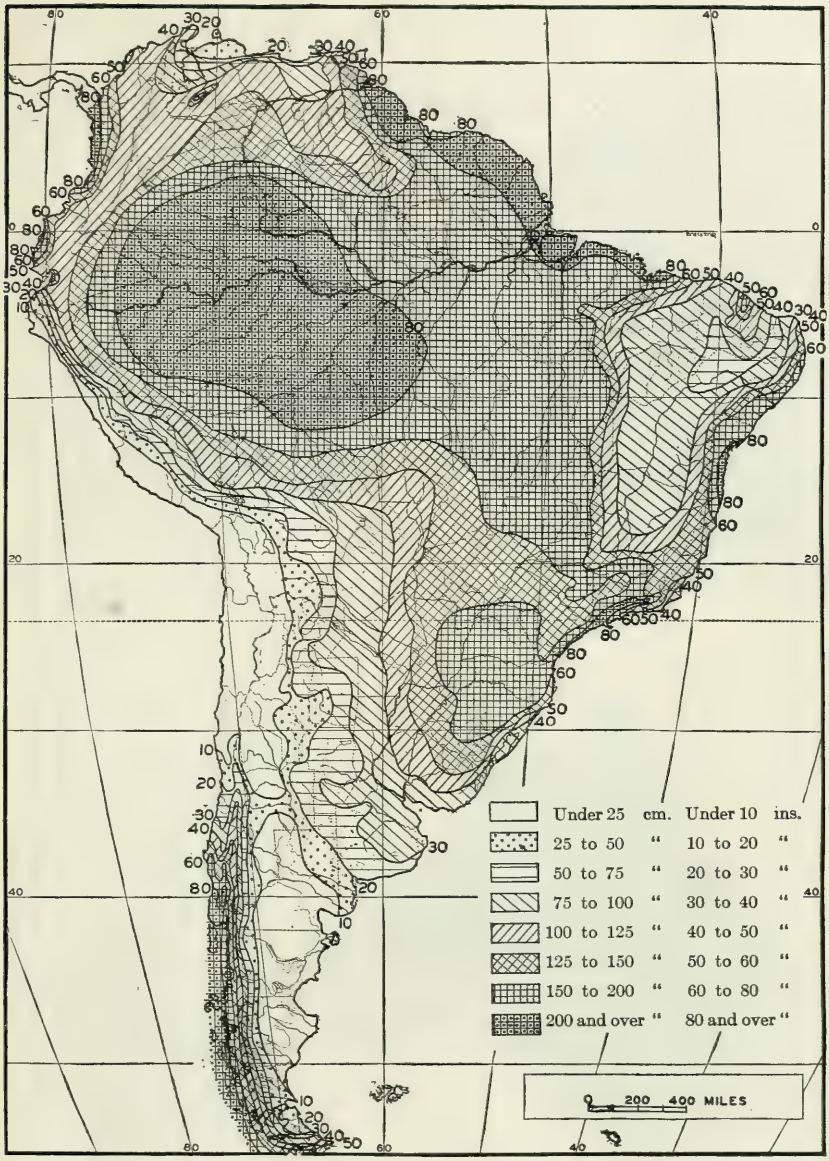

FIG. 17. ANNUAL PRECIPITATION

The areas of major development and the chief concentrations of population are regions of moderate precipitation. (*Drawn on Goode's Base Map, Sinusoidal Projection.*)

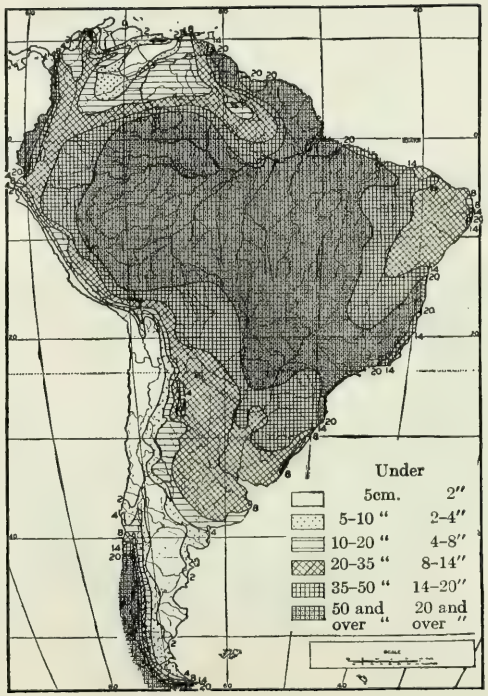

FIG. 18. AVERAGE PRECIPITATION, DEC.-JAN.-FEB.

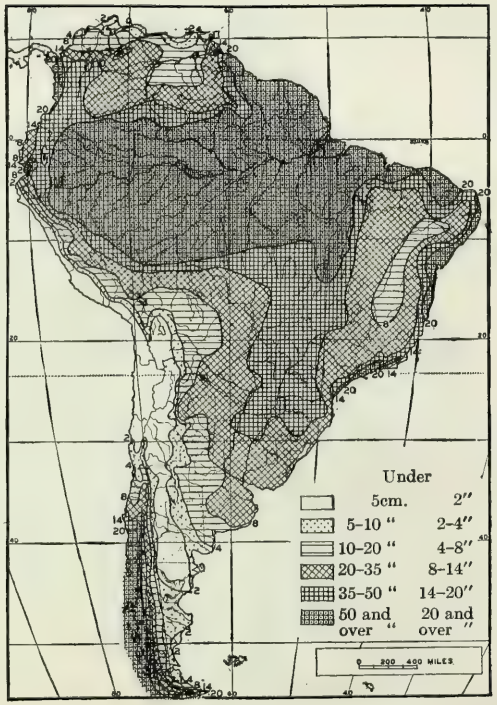

FIG. 19. AVERAGE PRECIPITATION, MARCH-APRIL-MAY

Of great significance in understanding the life of the people is the seasonal fluctuation of precipitation. These maps, based on original statistics from some 320 stations, give a fairly accurate picture of the rainfall régime. (*Drawn on Goode's Base Map, Sinusoidal Projection.*)

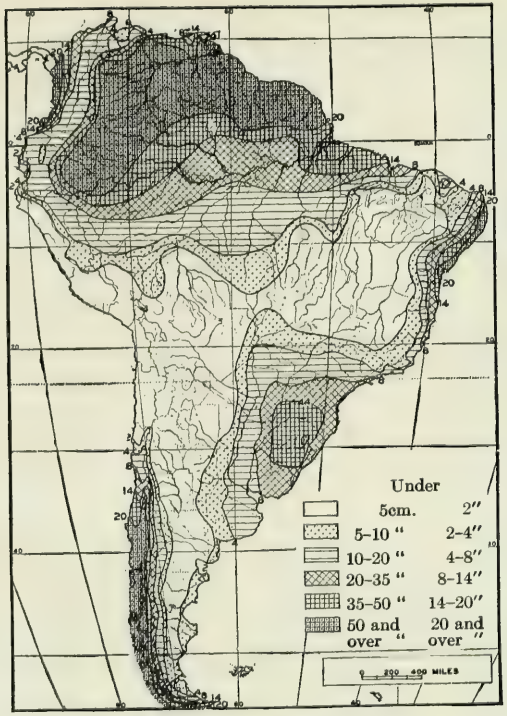

FIG. 20. AVERAGE PRECIPITATION, JUNE-JULY-AUG.

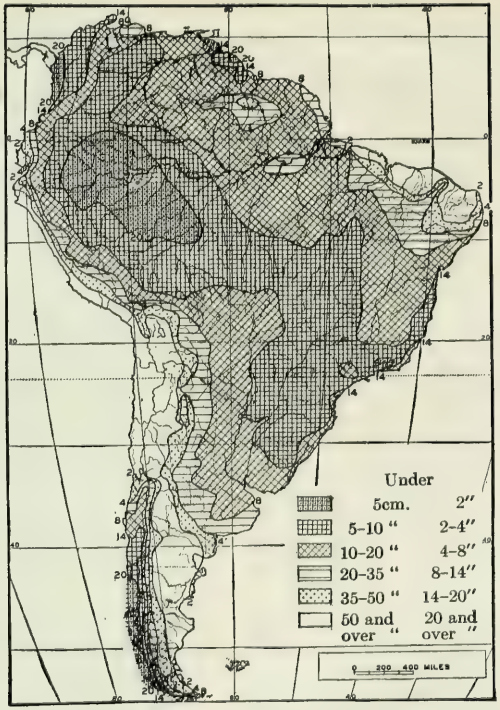

FIG. 21. AVERAGE PRECIPITATION, SEPT.-OCT.-NOV.

The maps for December-January-February and June-July-August show the profound influence of the migration of the vertical rays of the sun on the precipitation over a large share of the continent. (*Drawn on Goode's Base Map, Sinusoidal Projection.*)

Rainy High Latitude.—Though annual rainfall ranges from 10 inches in the east to more than 200 in the west, the Rainy High Latitude climate of southern Patagonia as a whole is one of the rainiest on earth (Figs. 17, 18, 19, 20 and 21). An outstanding characteristic is the lack of any notably dry period, each month receiving a substantial share of the yearly quota. On the leeward east, though the total quantity is small, the year is rainy, for the rains come in long light drizzles; and on the windward west coast, though the rains are far heavier, the same persistence of rainy weather is the rule. In the mountains fall prodigious quantities of snow. For the east coast, conditions at Puerto Gallegos and Magallanes well illustrate the case; for the west coast, Evanjelistas and Puerto Montt.

In consequence of the high latitudes and the continual rains, temperatures and the amounts of sunshine are low throughout the year, only the hardiest of agricultural industries being possible in the form of sheep grazing in southern Patagonia and on the Falkland Islands. In general, winter is relatively mild, but summer is decidedly cool. The windward west coast, where the raw wet winds make climatic conditions most inhospitable, shows the effect of marine influences on its temperatures, the mean annual range at Evanjelistas averaging only 8.3° F and at Puerto Montt 13.3° F. In contrast, the east coast, where the prevailing westerlies blow offshore, shows few marine characteristics, Magallanes having a mean annual range of 17.6° F and Puerto Gallegos 22.5° F.

Mediterranean.—North of the region of Rainy High Latitude climates lies a region having a far more hospitable climate. Indeed Mediterranean climate makes Central Chile a garden spot. As in southern California and the countries about the Mediterranean, winter rains and summer droughts prevail. In Santiago, for example, only 14 inches of rain falls each year, but more than three-fourths of this come in the winter—between May and September inclusive. Coquimbo which lies at the northern margin of the region has corresponding characteristics, though on a smaller scale. Within the region as a whole, rainfall shows a close relationship to topography, the coastal ranges in all cases receiving more rain than the valley in the same latitude and the middle slopes of the Andes more than either. Annual precipitation decreases northward from about 50 inches in the south to 5 at Coquimbo.

Though the great near-by Andean mass tends to lower temperatures, much of the region has general conditions favoring subtropical vegetation such as citrus fruits, palm trees, and the like. Owing to their comparatively enclosed situation, valley points have a considerable range of temperature, Santiago experiencing a mean monthly temperature of 68.9° F in January and one of 46.2° F in June. Coastal points, on the other hand, have an even distribution of temperatures, Coquimbo's annual range amounting to only 9.9° F. In general, winter is a season of considerable cloudiness, but the summer brings long stretches of brilliantly clear weather, with the penetrating rays of the sun through a cloudless blue sky.

Fig. 22. The Peruvian Coastal Desert

Only where silvery streams flow from the Andes do plants find nourishment in this parched, repellent land. The cloud bank clinging to the shoulder of the mountains is a prominent feature of the climate.

West Coast Desert.—In the middle stretch of the west coast of South America lies one of the world's pronounced deserts. Here the result of the warming of winds over the land after they have crossed the Humboldt Current all but precludes rainfall (Fig. 22). In certain localities many years pass without the slightest bit of recorded moisture. Iquique, a station typical of the drier sections, has an average of one day of rain per year and an annual total of five one-hundredths of one inch. Southward, northward, and towards the interior, however, rainfall totals increase slightly. Lima, for example, has almost 2 inches of rain per year. Winter is by far the cloudiest and dampest season, because then the land is relatively coolest and chills the winds from the sea.

The high sun and insignificant rainfall bring high temperatures and

bright skies, but as a whole the region has temperatures far below what might be expected, were there no Humboldt Current offshore or no pronounced and relatively cool southwesterly winds such as form conspicuous features of the coastal desert climate. Lima, which lies virtually in the same latitudes as Bahia, has a mean annual temperature almost 10° F lower than the east-coast city, and only 3.3° F higher than Rio Grande do Sul, lying 20 degrees nearer the pole. As in other desert regions, there is a marked difference in temperature between day and night.

Interior Desert.—To the east of the Andes lies another desert region. This differs from that of the west coast both in being less intensely desert and in showing continental interior characteristics in rainfall and temperature. It embraces a considerable area from southern Patagonia to the Andes of northwestern Argentina and southwestern Bolivia. For the larger part of the region, annual rainfall totals less than 10 inches, the eastern margins receiving greater quantities. Unlike the case on the west coast, here summer is, for the most part, the less dry season, San Juan receiving three-fifths of its moisture in December, January, and February. The southern mountains, because of their height, receive heavier precipitation than the adjacent plains; largely in the form of snow, this serves as an invaluable source of irrigation water for the piedmont oases.

Owing to the interior location and the basin-like character of much of the region, winters are relatively cool and summers hot. At San Juan, there is an annual range of 29° F, the summer averaging 15.5° F warmer than that at Coquimbo to the west over the Andes and farther north, and the winter 4.4° F cooler. The summer heat is occasionally made worse by the *zonda*, a hot northerly wind causing great discomfort to those living in the region as well as damaging crops.

East Coast Temperate.—This climatic region shows many likenesses to the Central Plains in the United States. Here come frequent changes in weather, owing to the procession of cyclones and anticyclones, and there are cool winters and hot summers. Distribution of rainfall resembles that for other steppe regions of the world, the maximum coming in spring and early summer. Though this greatly favors the growth of the important grains, frequent droughts may wreak great havoc on the crops. Winters are comparatively less rainy, but relative humidity is high. For the region as a whole,

annual precipitation increases from 20 inches on the west to more than 50 inches in the east.

Continental characteristics of temperature are well marked. Rio Cuarto, a station in the Wheat Crescent, and Rosario, a station in the corn region, have annual ranges in excess of 24° F. The warmth of spring and summer is broken several times annually by cold southwesterly winds—the *pamperos*. These set in suddenly as a cyclonic area moves eastward and cause unusually stormy wet weather for a short time after which the strong cold winds continue for several hours.

Subtropical Highlands.—Northeastward from the region of East Coast Temperate Climate lies an area of far different character. Here enters the influence of prevailing warm and moist northeasterly winds, and owing to latitude and altitude temperatures differ also. All of the region has more than 35 inches of rain per year and a good part more than 60 inches. Most of this falls in the warmer season, although practically every month has fairly abundant rains. At Rio Grande do Sul every month has more than five per cent of the annual amount, at Curityba more than four per cent. At São Paulo, however, during the winter when strong convection has decreased in importance there occurs a distinct dry period, June, July, and August accounting for only one-tenth of the total annual precipitation.

From the standpoint of warmth in summer and coolness in winter, the climate of the region as a whole is notably pleasant. The summer heat, which latitude might suggest, is lessened by the altitude of the plateaus, so that the mean summer temperature of 70.5° F at São Paulo is less than that for Rosario, which lies more than 500 miles to the south. Winters are generally mild, though there is risk of occasional frosts in enclosed low-lying plateau localities, a feature reflected in the distribution of coffee plantations.

Rainy Trade Wind Coasts.—This region consists of a narrow strip of land lying in general to the east of the Crest of the Serra do Mar. Here the southeasterly trade winds are the dominant climatic factor. All of the area receives more than 40 inches of rain per year and considerable parts more than 80 inches. The persistence of the prevailing winds gives each month abundant rainfall, but spring and autumn show clear maxima over the entire coast as at Rio de Janeiro, Bahia, and Pernambuco. Everywhere the humidity is great, but steady winds alleviate this condition.

Owing to the low latitude and the constantly high relative humidity, temperatures are markedly equable, Rio de Janeiro, Bahia, and Pernambuco respectively having annual ranges of 9.6° F, 7.7° F, and 6.3° F. Especially where local topography prevents full action of the sea-breeze, there is little change in temperature between day and night. In the south, fairly easy relief from the warmth may be had on the steeply rising seaward slopes of the Serra do Mar.

Semi-arid Trade Wind Interior.—In northeast Brazil lies a climatic region, baffling both to meteorologists and to its inhabitants. The latter frequently suffer greatly from prolonged droughts, the former find no clear-cut explanation for the drought or for many other features of the climate. Though much of the area receives more than 30 inches yearly, rains are precarious in view of the high temperatures. Most of this comes in doldrum rains about the time of highest sun, as at Quixeranobim, where four-fifths of the rains come between January and May inclusive. In the period from September to November, when the vertical sun apparently should again usher in rains, occurs a pronounced dry interval, the three months recording less than two per cent of the annual quantity. An outstanding feature of the climate is the recurrence of long periods of drought, which in coming as they do in a region of relatively dense population cause disastrous famines and great migrations.

Throughout the year the weather is hot, no month having a mean temperature under 78° F. In view of such great and uniform heat, drought assumes special significance. Under the burning sun, the rate of evaporation is high and consequently diminishes the effectiveness of such rain as falls. In the small highland *serras* occur more attractive conditions, rains increasing to more than 60 inches and temperatures decreasing.

Southern Hemisphere Savannas.—Next to that of the East Coast Equatorial Lowlands, this is the largest region in South America over which obtain relatively uniform climatic conditions. Despite its vast extent, it possesses certain distinctively regional features. The most conspicuous of these is winter drought, which accounts for the region's natural vegetation as well as for its major industries. Practically all of the region receives more than 30 inches, and more than one-half of it over 50 inches, per year. The concentration of considerable rains in one season and the almost absolute lack of rains in another are

striking features. June, July and August bring Cuyabá about one-seventieth of its average annual rainfall. About the margins of the region, as at Asunción and Morro do Chapeo, the dry period is less pronounced but still evident.

In general, the summers are hot and rainy, winters comparatively cool and dry. Cuyabá has nine months with a mean temperature above 77° F, but in the south and the higher east the heat is less prolonged. Winters in the south generally bring southerly winds with several days of frost, although in no month does Asunción's mean temperature fall below 63° F.

Northern Hemisphere Savannas.—These northern savannas closely resemble those of the south in climate, but inasmuch as they lie in the northern hemisphere the climatic controls differ. Here prevails the same sharp alternation of abundantly rainy season and intensely dry season. Thus, Calabozo receives more than 99 per cent of its rain between March and November, while the three-month period—December, January, February—when desiccating trade winds reach full power over the region, obtains less than one-tenth of an inch. Notwithstanding the 30 to 50 inches of annual rainfall, such drought periods dominate the economic potentialities of the region.

Owing to the basin-like character of the Llanos and of the Bolívar plains, high temperatures hold throughout the year. The coolest month at Calabozo, cool owing to the period of the heaviest rains, is warmer than the warmest month at Iquitos, the latter a station far nearer the equator and much farther inland. The terrific heat of the dry season, March having a mean temperature of 84.2° F, emphasizes the lack of moisture.

East Coast Equatorial Lowlands.—Within this region lies the largest area in the world having an annual rainfall of more than 80 inches, practically the entire region receiving more than 60 inches. Coupled with this is the great warmth of the forested lowlands in equatorial latitudes, and there results undiluted tropical climate (Fig. 23).

A location in the belt of doldrum rains, the constant importation of moist northeasterly and southeasterly trade winds, their convergence owing to the shape of the Andes, the vast forests transpiring enormous quantities of water, and the colossal river systems: these give the region the bases for its unmatched rainfall. The greatest rains fall in

the west, some areas receiving 125 inches per year. Eastward rains decrease, until at the mouth of the Amazon conditions like those on the Guiana coast favor greater rains. Illustrative are Iquitos with 103 inches, Manáos with 72 inches, and Pará with 98 inches. Georgetown under conditions like those at Pará has 92 inches, but Port of Spain, lying as it does in the lee of the northern mountains of Trinidad, receives only 64 inches per year. Over so expansive an area, there must be differences in distribution of rains, but in general no part of the region suffers notably from the lack of rain in any month. Variations in seasons of maximum and minimum rainfall depend upon

FIG. 23. IN A HOT HUMID CLIMATE

A pole, palm-thatched hut with a steep roof serves to protect the natives from the hot rays of the sun and the daily drenching convectional showers. Ducks are swimming in the water under the hut.

location with respect to vertical sun and doldrum conditions and trade wind activity.

In respect to temperatures, all of the region shows an outstanding evenness in great warmth from month to month. The annual ranges at Iquitos, Manáos, Pará, Georgetown, and Port of Spain are respectively 4.2° F, 2.7° F, 2.6° F, 2.3° F, and 3.9° F. While the mean annual temperatures and the monotonous regularity of mean monthly figures seem to indicate uncomfortable weather at all times, such is not the case. Each day brings fairly large changes in temperature, the region's winter actually coming at night each day, and the frequent violent thunderstorms greatly refreshen the atmosphere.

West Coast Equatorial Lowlands.—The detached strips of heavy rains along the coasts of Ecuador and Colombia are analogous in many ways to the East Coast Equatorial Lowlands. Here year-round doldrum rains and on-shore winds blowing over a warm sea-current bring about the heaviest rains on the continent. The coastal range of Colombia is drenched, Andagoya receiving an annual deluge of 23 feet of rain, Buena Vista almost 28 feet. At the far south, the region shows to advantage the transition to the West Coast Desert, Guayaquil, having considerable rains with the high sun and little when the sun is farthest north. On the highlands east and south of Guayaquil, however, elevation causes an increase of total annual precipitation. Most of the region has abundant rain in all months, the least monthly total at Andagoya surpassing the yearly figure for easily one-third of Argentina's area. Nevertheless, two slight maxima occur, one in April, the other in August and September; these constitute the true double maximum type of equatorial rainfall and correspond to the times of vertical sun. The number of rainy days is astonishing; the natives say that rain falls every day. Like the East Coast Equatorial Lowlands, this region shows distinct regularity in the temperature curves, Andagoya especially well because of the constantly high relative humidity. The mean for April, the hottest month, and that for December, the least hot month, differ by only 1.4° F.

Semi-arid Trade Wind Coasts.—In a rather compressed strip along most of the Caribbean coast lies a region of light rainfall, in places totalling less than 20 inches per year, in others over 40, rapid evaporation in all cases reducing the effectiveness of such precipitation as occurs. The most obvious of the causes lies in the influence of the northeasterly trade winds, which here gather moisture as they sweep over the land. Modifying the trade wind effects are (1) cold waters off the east Venezuelan coast, affecting the climate much as the Humboldt Current modifies that of the West Coast Desert, and (2) the lack of relief of such topographic features as the Segovia Highlands and parts of the Colombian coasts. Heaviest rains come about the time of the vertical sun, as shown at Cartagena and Maracaibo. Succeeding the seven-month stretch of rains comes a five-month period of prolonged aridity, when both stations receive less than 2 inches of rain. Great warmth prevails through the year in consequence of the low altitude; despite its latitude, Maracaibo, on a flat open basin, is

one of the hottest spots in South America; its mean annual temperature is greater than that for the warmest month at equatorial lowland places like Pará or Iquitos.

Low Latitude Highlands.—Though the great variety in elevation and relief makes this region exceedingly complex, it presents a certain unity of climatic character in that the highland character exercises a predominating influence. Stretching as it does from 11° N. to south of the Tropic of Capricorn, it embraces many distinct types of rainfall, all of which, however, show a resemblance in the rainy and dry

Fig. 24. Eastern Cordillera, Near Cerritos, Colombia

A field of golden wheat at 9,200 feet in a temperate climate with about 40 inches of rain. Above the wheat fields, temperate grasses, and higher the damp cold clouds drifting over the *páramo*.

seasons. In general the rains are heaviest in the north and on the east slopes, while towards the west and on the punas of the far south decided aridity prevails. Thus the Sierra Nevada de Mérida and the Sierra Nevada de Santa Marta experience considerable rains, the former more than 70 inches, and two additional northern areas—Bogotá and Quito—receive 40 and 44 inches respectively (Fig. 24). Southward, La Paz obtains 21, Cochabamba 18, and La Quiaca 13 inches. In many areas exposed slopes get heavy rains, amounts sufficient for coffee and cacao, lee slopes obtain less and low narrow valleys hardly enough for a good growth of grasses. With respect to seasonal distribution of precipitation, much of which falls as snow in the higher

lands, two types are clear. The areas near the equator display to advantage the double maximum of rainfall as occasioned by the two equinoxes, while farther south there is a close correlation between time of the summer solstice and rainy season—a fortunate arrangement from the standpoint of the already sufficiently handicapped highland farmer.

In regard to temperatures, several distinctive features arise. The areas near the equator show the same uniformity of temperature from month to month as those in the lowlands. Quito has an annual range of 0.4° F, Bogotá of 1.6° F, with the result that each has been known as a city of perpetual spring. The delights implied by such a designation actually are far from the truth, for the average march of weather leaves much to be desired; some have said that at Quito and Bogotá the seasons occur each day, the day being warm enough to make night welcome, the night cold enough to make day pleasant. Cold uncomfortable fogs, rains, and hail are common. The southern zones show a characteristic range for highland areas at their latitude. As everywhere in the region, daily ranges are great, the daytime heating by the sun in the thin clear atmosphere and the rapid nocturnal radiation of heat by the bare rock surfaces making for considerable and unpleasant contrast between day and night.

THE CLIMATES AND THEIR SIGNIFICANCE

Although South America in respect to climates is less blessed than all three northern hemisphere continents, it stands supreme among those of the southern hemisphere. Here are fourteen distinct climatic regions, many of which might bear further refinement, ranging from among the most tropical to the polar. In consequence the continent enjoys opportunity for a noteworthy exchange of certain products within its own borders; and because of the reversal of its seasons as compared with those of the northern hemisphere, the bases for commercial development are augmented to a considerable extent. While the continent has no such happy combination of climates and available mineral and forest resources as in North America or Europe, nevertheless the advantages of its several climatic regions have accounted for much of its tremendous economic advance.

CHAPTER IV

NATURAL VEGETATION

The primitive stage of development characterizing much of the continent lends particular significance to the plant life of South America. As in other pioneer lands, every important human adjustment has shown certain intimate relations to natural vegetation. Many of the major natural provinces are still distinguished exclusively on the basis of a regionally typical flora, and every human activity bears some impress relating to plant life, whether in the sere yellow and brown Coastal Desert or in the wet evergreen forests of Amazonia.

THE FORESTS

In respect to forest resources, as compared with North America or Europe, South America suffers distinct handicaps. Despite the actually large area supporting tree growth, conditions of climate and accessibility in the main tend to hamper exploitation. Nevertheless, the unique nature of some of these forests has occasioned striking developments in many parts of the continent, in all cases, however, only where transportation facilities have proved somewhat less difficult.

Tropical Rain Forest.—For a vast part of South America, the tropical rain forest represents a major obstacle to settlement. To be sure, it provides an abundance of primary materials for food, shelter, and manufactures. On the other hand, so completely do such forests as those of Amazonia or Pacific Colombia impede overland travel, that their wealth remains to a large extent unavailable. For some of these growths, this situation will hold for centuries. While the climatic and edaphic conditions of tropical South America occasion an apparently uniform physiognomy for all of its rain forest, four subdivisions may be recognized on the basis either of actual physical separation or of specific differences in composition (Fig. 25).

Amazon.—In the vast sweep of lowland stretching from the mangrove thickets of the Atlantic shores for 2,500 miles to the eastern

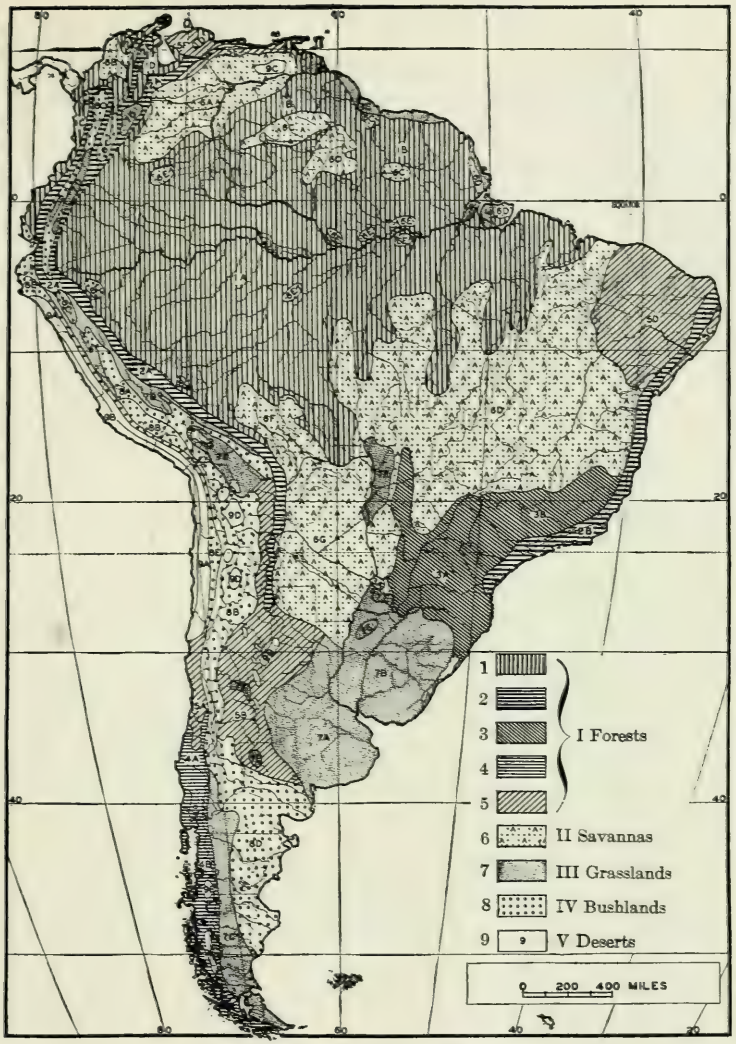

FIG. 25. NATURAL VEGETATION

I. FORESTS
- 1. Tropical rain forest
  - 1A. Amazon
  - 1B. Guiana
  - 1C. Pacific
  - 1D. Caribbean
- 2. Mountain tropical rain forest
  - 2A. Andes
  - 2B. East Brazil
- 3. Subtropical rain forest
  - 3A. South Brazil
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A large part of the continent of South America is in forest and savanna. (*Drawn on Goode's Base Map, Sinusoidal Projection.*)

Andean slopes lies the world's greatest expanse of tropical rain forest. Here and there, where local conditions of soils, ground water, or climate interrupt the typical régime, occur savannas of limited extent, but the dominant expression of the area as a whole is that of heavy forest, growing in response to the uniformly warm and humid climate.

The variety of regional wealth in plant life is astonishing, great enough to lessen considerably the economic value of the plant cover. In the two-, three-, and occasionally four-story growth of giant timbers, slender and tall palms, and widespread thickets of bamboo or other tropical brush, luxuriates a tangle of lianas, creepers and epiphytes. Over wide areas the lower forms may be absent entirely, owing to the dense shade of the canopy of leafy crowns. Here the seeker of rare flowers can best discover the objects of his search from an airplane, for the conditions of light confine blooms to the top of the forest.

While scattered occurrence of trees, tangles of underbrush, and high specific gravity hamper utilization of the forest, nevertheless certain species have a worth so great as to have brought the farthest reaches into use. The *seringueira* (*Hevea brasiliensis*), as the principal source of rubber, has been the most influential single factor in opening Amazonia to economic development. Together with the valuable cacao (*Theobroma cacao*), the *seringueira* grows in the periodically flooded alluvial plains. On the drier uplands, the forest attains its greatest variety; here are utilized chiefly the Brazil nut (*Bertholletia excelsa*) and a second source of rubber—*caucho* (*Castilloa elastica*). Though their weight in many cases causes them to sink in water, timbers come from many parts of the forest, but as yet in relatively insignificant quantities.

Guiana.—For much of its area, the Guianan Tropical Rain Forest displays a wealth of plant life in many ways equal to that of Amazonia proper. As is the case with the Pacific and Caribbean sections of the tropical rain forest, however, certain distinctive species set it off from the great interior.

Here grows the characteristic profusion of forms, but in place of rubber and Brazil nuts as the chief products, the region yields *balata* and a number of valuable timbers, principally greenheart. The comparative importance of timbers results from proximity to the sea and river highways.

Like the *seringueira*, the tree yielding *balata* (*Mimusops globosa*) occurs in scattered solitary specimens or in clumps. It too has been the most valuable single product of the forest and has contributed greatly to the spread of population into the interior. The timbers, worked chiefly in British Guiana, embrace five principal sorts: greenheart (*Nectandra rodioei*), *mora* (*Dimorphandra mora*), crabwood (*Carapa guianensis*), wallaba (*Eperua*, sp.), and cedar (*Cedrela odorata*). Greenheart is economically the most valuable of these, wallaba the most abundant. More common in the western portions of the region, the tonka bean adds another item to the varied produce of the forest. The tree, *Dipteryx odorata*, grows chiefly in the Coura and Cuchinero Valleys, near the Orinoco River.

Pacific.—Though completely separated from Amazonia by the great Andean mass, the strip of tropical rain forest extending from Southern Ecuador to northwestern Colombia closely resembles the eastern stands. Exploitation proves more difficult by reason of the greater relief; the region may be further distinguished by its principal species of commercial significance: *Phytelephas macrocarpa*, producing the *tagua* nut; *Castilloa elastica*, yielding *caucho;* the *toquilla* palm (*Carludovica palmata*), which furnishes fibers for Panama hats; and the silk cotton tree, *bomba ceiba* (*Ceiba pentandra*), an important source of kapok. The cutting of timbers is negligible.

Caribbean.—This forest type is set off chiefly by its physical separation from other similar areas and consists of four detached parts, located about (1) the lower Magdalena and Cauca Valleys, (2) the base of the Sierra Nevada de Santa Marta (Fig. 26), (3) the Maracaibo Basin, and (4) the Tocuyo Valley. In composition this forest is much like that of the Pacific Margin, but because of its fortunate disposition relative to navigable waters, it yields an important amount of timber in addition to most of the leading products of the west. The principal district of production lies about the western shores of Lake Maracaibo, whence come mahogany, rosewood, ebony, and lignum-vitae.

Mountain Tropical Rain Forest.—The tropical rain forests of parts of mountain South America have a richness of vegetation scarcely approached even by that of the Amazon forest. Although this natural wealth has considerable commercial significance, the productiveness of these areas ranks far below that of the lowland tropical rain forests.

Ruggedness and, for much of the area, distance from the sea account for this. In the latter connection, however, two divisions arise: the zone of the Andes and that of eastern Brazil.

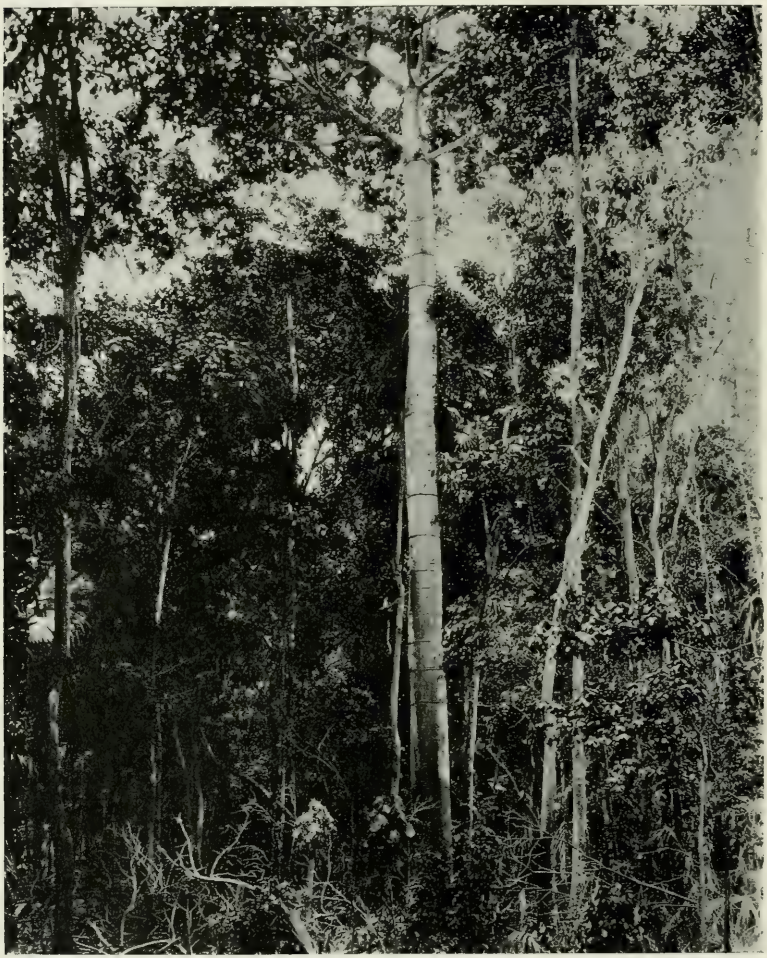

FIG. 26. TROPICAL RAIN FOREST, SOUTH OF SANTA MARTA, COLOMBIA

In response to a uniformly warm and humid climate a luxuriant growth of vegetation includes a variety of tropical hard woods, lianas, and epiphytes, making a wall of green difficult to penetrate.

Andes.—While the climatic conditions on the western slopes of the middle Andes disrupt the symmetry of the mountain forest, this type shows a notably uniform make-up. In a great crescent of dense tree

growth, from the Caribbean to Tucumán in Argentina, it has arisen in response to the heavy rains and elevated temperatures of lower and outer Andean slopes. In bridging the break between plains and high mountain vegetation, the forest has acquired characters common to

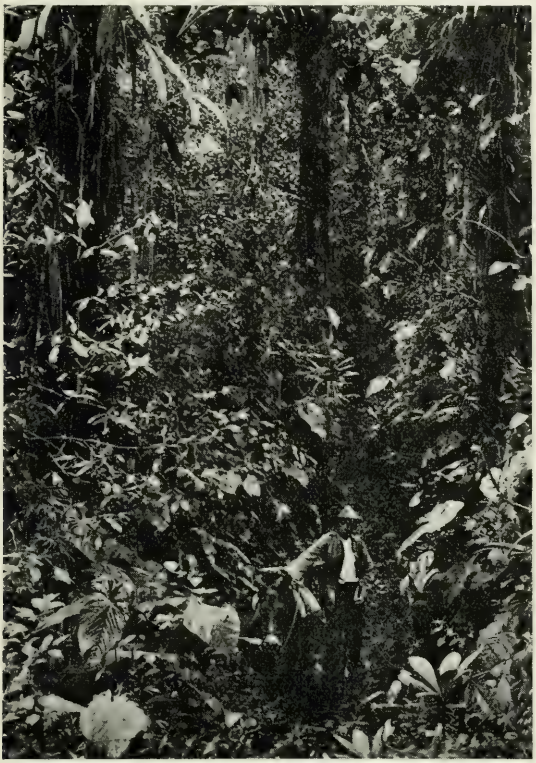

FIG. 27. SUBTROPICAL MOUNTAIN RAIN FOREST

The density of vegetation of trees, lianas, epiphytes and undergrowths in the narrow zone on the Andean subtropical rain forest surpasses that in many of the tropical forests in the lowlands. Western slope of Central Cordillera at Miraflores, Colombia. (*Photo by Frank M. Chapman; courtesy of the American Museum of Natural History.*)

each and thereby great diversity (Fig. 27). Its width, between the lower margin and a maximum elevation of almost 10,000 feet attained in Ecuador, rarely exceeds 30 or 40 miles. Arborescent ferns, paucity of palms, and former abundance of cinchona are the chief distinguishing features.

The Andean Mountain tropical rain forest at present supplies few

forest products, the exploitation of cinchona having declined in consequence of the rise of Far East competition and coca (*Erythroxylon coca*) now having become a cultivated crop. Remoteness makes the numerous valuable elements available largely for only local use, except about Guayaquil, where an ocean front lends considerable value to the growth. In return, the forest has a certain value in indicating those rich lands having the productive capabilities of wet tropical lowlands minus their excessive warmth; such are the Yungas of Bolivia and the *Ceja de Montaña* or mountain forest zone of Peru.

East Brazil.—Despite their greater distance from Amazonia, the forests clothing the seaward slopes of the Serra do Mar bear closer resemblance to the equatorial stands than those of the eastern Andean slopes. Heavier rainfall and lower elevations account in large part for this relationship. These forests differ further from the western districts in that their proximity both to the sea and to desirable interior lands has caused a high degree of utilization. In the northeast particularly, the forest zone, or *matta*, coincides exactly with the most valuable agricultural areas. Coastward, the forest in many small districts of sandy or marshy character gives way to savannas or diminutive growths of gnarled trees.

The heavy precipitation and great warmth throughout most of the year have induced a plant cover analogous in many respects to that of the northern tropical rain forests. Various differences naturally obtain as a result of regional location, but here exists the same somber perpetual green and an even greater diversity of plant life. A total lack of *Hevea brasiliensis* constitutes the most noteworthy departure from Amazon forests. With respect to the Andean mountain forest a homologous feature is the abundance of arborescent ferns at elevations above 1,000 feet.

Along the streams and in the mountains many small mills handle the timbers brought to them. Hard woods compose the bulk of woods worked. Of the types constituting tropical stands, 40 per cent resemble birch, beech, maple, and ash; 20 per cent hickory; 10 per cent mahogany; one per cent rosewood; and 10 per cent Spanish cedar.

Subtropical Rain Forest.—The forests of South Brazil and of the Central Plateau of Eastern Brazil, both from the botanical and the economic viewpoint, have especial significance. Their general aspect

is far different from that of the tropical forests, although here, too, the major forms are evergreen. Variety of species is smaller and the several forms show a greater inclination to grow in groups, thereby giving the region a marked advantage in lumbering. Moreover, valuable soft woods form a large part of the total growth, a feature of importance in the light of the requirements for building materials in the populous agricultural lands lying within the boundaries of the forest area.

South Brazil.—On the rolling uplands of southern Brazil, northeastern Argentina, and eastern Paraguay lies one of the most valuable forest reserves in South America, in a zone of transition from tropical to temperate conditions. The comparative temperateness of the region is enhanced by the appearance of the most important conifer of the continent. In view of the striking deficiency of South America in soft woods the cover of Paraná pine becomes a singularly worthwhile asset.

Two species, the Paraná pine (*Araucaria brasiliana*) and *yerba maté* (*Ilex paraguayensis*), preponderate among the plant life. Both extend over a considerable area, the pine somewhat restricted to the east of the upper Paraná River, *yerba maté* growing in the pine forest and also stretching northwestward into eastern Paraguay and southern Matto Grosso. The western margins of the forest in Paraguay and the eastern sections about the Serra do Mar introduce an augmented number of species. Here and there conditions of soil or elevation permit savannas to interrupt the forest continuity.

The saw-mills of interior Santa Catharina and Paraná have developed a significant industry based primarily on the Paraná pine. Primary cutting came with the clearing of land to be devoted to tillage, but later the industry secured an independent basis. To the west, Paraguay's access to navigable rivers permits exploitation of a number of hard woods. Though of some import, production of both soft and hard woods holds far less significance than the gathering of the holly-like evergreen leaves of *yerba maté*. This industry flourishes in all parts of the region. In recent years, the popularity of this commodity has caused a shift of the industry from its original dependence on wild trees to a plantation basis in some sections.

Central Plateau of Eastern Brazil.—The extensive removal of the original vegetation by the advance of agriculture has further increased

the bewildering heterogeneity of plant life in eastern São Paulo and southeastern Minas Geraes. Within the confines of the region the forest predominates, but over large areas it grades into savanna and scrub forest or *caatinga*. The tree cover has had less utility than that of the South Brazil section, but the richness of the *terra rossa* soils occupied by the forest has led to its widespread removal for agriculture.

As a whole, the area has no outstanding or regionally typical species. It is a transition zone partaking chiefly of the characters of adjacent areas—a truly mixed forest. At the west occur occasional groves of Paraná pine, but in negligible quantity; northward xerophytic features set in, cacti becoming abundant near the margins; to east and south, a wealth of hard woods like that of the forest on the coastal slopes covers the land, the elevation differentiating the region from that to the east by permitting dense growth of bamboos and ferns above 2,000 feet; over all of the region, in clumps of moderate size, extend various palms.

Temperate Rain Forest.—For more than 1,500 miles, from latitude 35° S. to the southern extremity of the continent, extends the largest stand of the temperate rain forest. Similar temperate rain forests occupy a narrow zone above the mountain tropical rain forests in the northern Andes (Fig. 28). For virtually all of this distance it embraces the width of Chile and also takes in the narrow forested section of western Argentina. In the north, this is one of the densest forests of the world. Heavy rains give the area an exceptional wealth of species, almost rivalling that of the tropical rain forests. Here abound numerous valuable kinds of hard woods and soft woods, growing in a tangle of leaves and epiphytes and denying a full quota of possible light to the thick underbrush of bamboos and ferns. Despite its proximity to the sea and its stands of useful timbers, much of the region represents the least utilized portion of South American forests; a condition due to an excess of rainfall in a region of relatively low temperatures—at the same time the cause for the forestal richness.

Middle Chile.—In this northern section, the forest has undergone the most widespread utilization, but a large part still remains practically untouched and indeed unexplored. The lands below an elevation of some 4,000 feet support a heavy cover of mixed deciduous and evergreen trees, while between 4,000 and considerably more than 5,000

feet lies the almost pure stand of Chilean pine which embraces part of Argentine Neuquén.

The *roble* (*Nothofagus obliqua*), a deciduous beech, and the *coihué*

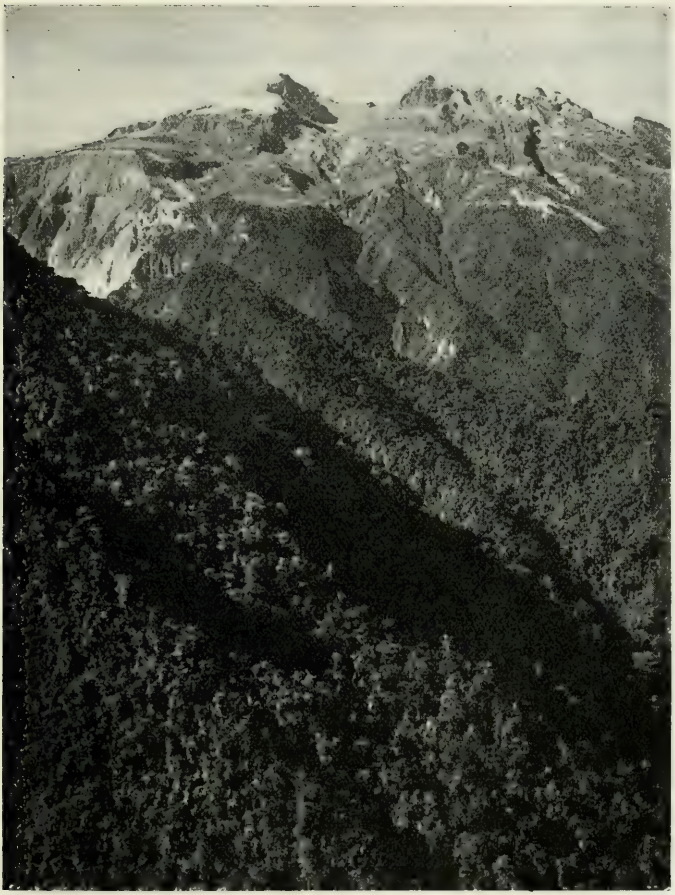

Fig. 28. Temperate Andean Forests, Ecuador

In many parts of the Andes narrow temperate forests of dense growth clothe the slopes between the subtropical forest and the higher grasslands and *páramo;* the north side of Tinchincha, Ecuador. (*Photo by Frank M. Chapman; courtesy of the American Museum of Natural History.*)

(*N. Dombeyi*), also a beech but evergreen, are the most typical trees. Most northerly in range, the *cipres* or *cedro* (*Libocedrus chilensis*) brings the rain forest almost to the latitude of Santiago. The Chilean

pine (*Araucaria imbricata*) constitutes a fourth distinctive species and grows almost exclusively between latitudes 37° S. and 40° S.

All of these trees and many minor types have considerable value as lumber materials. Development, however, has not included the mountain pines because of their inaccessibility. Though already one-half of the land has been cleared, every farm having its woodlot, a large part of the remainder has its major utility in the protection it affords the native Araucanian folk. Frequent heavy rains and paucity of transportation facilities render work difficult.

South Chile.—Except for the handicap of excessive rainfall, the temperate rain forest is one of the most easily accessible stands of South America. The greater part of the area, however, lies untouched, a drenched solitude of dark green forest. Southward, increasing rains and cold cause a progressive impoverishment of the vegetation, large expanses supporting only a meagre cover of stunted growths or, in the case of the ice fields, none whatever.

Here again the beeches are well developed, ranging over the entire latitudinal extent. In the far south, however, the *roble* and *coihué* give way to two other beeches, *Nothofagus antarctica* and *N. betuloides*, deciduous and evergreen, respectively, and both small trees reaching low elevations. About the Gulf of Ancud, the forest attains its greatest profusion of species and its greatest commercial import. The *alerce* (*Fitzroya patagonica*), a magnificent tree similar to North American redwoods in point of size and utility, and the *canelo* (*Drimys winteri*) swell the list of desirable species.

The settlements at the head of the Gulf of Ancud have worked the near-by forests for centuries. As elsewhere in the region, numerous difficulties beset lumbering, but in comparison with the problems afflicting the southern areas exploitation proves easy. In fact, the abundance and usefulness of the enormous *alerce* and its accessibility have led to a near extermination of the species.

Dry Forest.—As a major group, the dry forest has more diversity among the several subdivisions than any of the other forest classes. The *chaparral*-like vegetation of Mediterranean Chile affords little superficial semblance to the *monte* of Argentina or the *espinar* of Caribbean Venezuela. In respect to the physical causes for each type, however, little variation exists; each represents the vegetal adjustment to a land characterized by marked drought, whether directly

climatic or an outgrowth of soil conditions, during one well-defined season. Additional similarity holds with respect to the adoption of xerophytic characters, though this varies from one subdivision to another, one being predominantly evergreen, another deciduous. On the whole, these thin forests have little tangible value when compared to other areas having arborescent growths, but to the inhabitant they are an intensively utilized natural resource. For most of the lands, the actual poverty of vegetation enhances the utility of each plant, a gnarled length of tough *algarroba* holding infinitely more significance in the eyes of a goat-herder living in the *monte* than a long clean hole of precious cabinet-wood in the regard of a forest Indian in western Amazonia.

Mediterranean.—The seasonal rhythm of rainfall in Middle Chile occasions a native flora closely paralleling the *chaparral* of the southwest of Pacific United States or the *maquis* of Mediterranean Europe. In its southern portions, the region has an open growth composed principally of various acacias and laurels, more dense on the coastal plains than in the Central Valley. Northward, the tree growth diminishes and numerous cacti constitute the dominant element of the plant life, although low bushes and various grasses are abundant. Except for the grazing afforded by the grasses, the natural vegetation here supplies little to the native, both because a large part of the land lies in farms and because trees grown under irrigation provide a readily available source of wood. Here, as in the oases of western Argentina, the tall lombardy poplar and taller eucalyptus raise their leafy spires along every irrigation canal as well as in woodlot plantations.

Monte.—Relative to utilization of resources in wood, the *monte* covering the dry interior lands of Argentina ranks among the most valuable of the dry forests. A gray-green expanse, it originally formed a close thorny forest over most of its habitat. Although about its margins, the formation may be displaced by fingers of low bushes to the west or Pampa grasses to the east, it consists primarily of an upper story of thorny acacias and mimosas, the trees more than fifteen feet tall growing only in comparatively well-watered places. Underneath, a few scrubby bush-forms dispute the meagre surplus of water with a sprinkling of bunch grasses. Each tree, shrub, or clump of grass is separated from the next by bare soil.

The *algarroba* (*Prosopis juliflora*), the *chañar* (*Gourliea decorticans*),

and the *caldén* (*Prosopis algarrobilla*) are the most typical trees; the *caldén* is the southern counterpart of the *algarroba*, while the *chañar* thrives in moister spots over a good part of the region. The stands of largest trees spread over the slopes of the Sierra de Córdoba. Cacti abound and especially in the north attain huge size. Westward and at higher elevations a zone of bush displaces the *monte* proper. In its lower districts, the *jarilla* (*Larrea divaricata*) surpasses all others in prominence. Higher and in the south a South American sagebrush, the *ajenjo* (*Artemisia mendocina*), reaches broad development.

Certain of these species have been almost completely removed over large areas as a result of the scarcity of wood in these arid lands. The *algarroba* in particular has suffered, its durable wood, however twisted and short the trunk, ministering to regional needs in many ways.

Northeast Brazil.—At one time supporting a forest rich in dyewoods and valuable timbers, a narrow sandy coastal strip from Northern Bahia to Parahyba now presents a far different appearance. So thoroughly has man culled the vegetation of its useful elements that now there remain inland from the strip of mangrove swamps only a sparse stand of scattered scrubby trees and a few low annuals. During the dry season, the zone has a pronounced desert aspect.

Caatinga.—The *caatinga* of Northeastern Brazil displays a remarkable contrast in aspect between dry season and rainy season. During the pronounced drought of the former period, the thick brush covers the plateaus with an apparently dead growth of whitish wood, broken only by the small areas of mountain tropical rain forest on the *serra* heights of the north. With the advent of the rains all plant life quickens with astonishing vigor and soon a leafy mantle of fresh green is produced. In the drier parts or those deficient in soils, the change is less abrupt owing to the dominance of cacti.

Mimosas in great variety preponderate over most of the area. Prominent also are plants reflecting rain and drought by their water-storing organs: especially various *Bombacaceae* of smaller trunk and many fleshy cacti. In the west, the *manicoba* (*Manihot glaziovii*) is an important growth in that it furnishes a not inconsiderable quantity of rubber, while along the moist bottoms of valleys grows the valuable wax-producing *carnauba* palm (*Copernicia cerifera*). The several

trees and shrubs have much aggregate importance, but of greater significance to the average inhabitant are the herbaceous forms which quickly rise in profusion following the rains and provide forage for the region's livestock.

Venezuelan Chaparral.—For several hundred miles at their northern margins, the Llanos grade into a zone of dwarfed twisted trees known as the *chaparral,* distinguished by the *curata* (*Curatella americana*), the *alcornoque* (*Bowdichia virgilioides*), and the *chaparros*

Fig. 29. Caribbean Coast Vegetation

An arid vegetation on which goats find poor pickings. *Cujies* (*mimosaceas*) *Cardones* (*Cereideas*) and *Tunas* (*Opuntia caribaea*). (*Courtesy of Peter Christ.*)

(*Byrsonima,* sp.) These give way in some more moist districts to a richer forest composed largely of taller deciduous trees. Though a paucity of thorns and cacti lend an air far less xerophytic than that of the dry forest located on the Segovia plateau, this stand has comparatively little utility.

Caribbean Espinar.—The excessive aridity caused by scant rainfall in a region of high temperatures gives a markedly barren aspect to the vegetation on the northwestern coasts and the Segovia plateau of Venezuela and on Colombian Goajira. Numerous cacti mingle with thorny trees and shrubs over most of the region, although in some areas stands of palms indicate the locations of high water table (Fig.

29). Various mimosas preponderate among the economically significant growths; two small trees are of outstanding importance: the divi-divi (*Caesalpinia coriaria*), the fruits yielding tannin copiously, and the useful *guayacán* or lignum-vitae (*Guaiacum officinale*).

THE SAVANNAS

The savannas of tropical and subtropical South America constitute one of the world's greatest potential grazing preserves. The warmth, seasonally deficient precipitation, and in cases the droughty soils of approximately one-fourth the continental expanse have brought about several areas capable of supporting many million medium-grade cattle. Though among the regions the handicaps to grazing vary, each savanna land has about the same suitability. In respect to plant life, no such uniformity exists, except that of the savanna character, the most notable differences arising from the tree growths.

Llanos.—Over considerable areas, the llanos entirely lack trees but in certain patches, as in river bottoms, dense groves break into the domain of grasses. In general, however, the savanna character is amply indicated by the contrast between the rainy season lush green sea of waving grasses studded with islands of occasional trees and the dry season sere brown poverty of vegetative growth.

Tall bunch grasses give the llanos their most extensive plant cover. *Paspalum, Andropogon,* and *Panicum* compose the bulk of the stand. The *palma redonda, Copernicia tectorum,* and the *moriche, Mauritia flexuosa,* two palms of great usefulness growing in humid soils, are characteristic, the former in the north, the latter in the east; in the southwest a considerable variety of trees indicates the transition to the tropical rain forest of Amazonia.

Bolívar.—Including much marsh land, the Bolívar plains and the low lands along the lower Magdalena support a savanna formation which has long been the scene of pastoral activities. In many ways it resembles the frequently inundated portions of the central llanos, but is bordered on all landward sides by heavy forest. Tree growth consists principally of scattered mimosas, acacias, and tall palms. In value for grazing, the Bolívar savannas surpass the llanos, owing both to the superiority of native grasses and to the widespread cover of introduced *Pará* and *Guinea* bunch grasses.

Guiana.—The several savannas lying completely within or adjacent to the tropical rain forests of northern Amazonia and of Guiana are much like the llanos, except that their presence within the forest gives them a greater diversity and abundance of trees. Comparatively little use is made of these savannas, the Rupununi district, which extends into the lands about the Rio Branco, and that area in northeastern Demerara collectively supporting a few thousand head of cattle.

Campos.—In area the Campos exceed all other savannas of South America combined. Nevertheless, with a maximum north-south extent of 1,700 miles and east-west of 1,500 miles, a decidedly uniform type of vegetation distinguishes the land. As in the llanos, tree growth along streams may reach large proportions, but the typical landscape embraces a far-flung expanse of tall grasses generally with a few trees—mimosas, acacias, or palms—widely dispersed; such is the *campo cerrado*. Should the area lack trees altogether, it bears the name *campo limpo*.

As a rule, the grasses are tall and hard, the trees low and twisted, and as elsewhere in the savannas a signal change in general appearance occurs from one season to the next. Typical forms which in districts exclusively hold the land include the *sambauva* (*Curatella americana*) —a low stunted tree which grows in the llanos also, the *mangabeira* (*Hancornia speciosa*)—a shrubby plant yielding rubber, and the *burity* palm (*Mauritia vinifera*).

Amazon.—In the lower portion of the Amazon, in the less rainy part, are a number of small savannas in response to moisture and edaphic conditions. Though small in area, they have significant development.

Mojos.—Exceedingly rich in variety of plant life among South American savannas are the Mojos plains. These extensive alluvial flats owe their dominant formation to a long period of widespread inundation by the Mamoré River, but their wealth of vegetation is due to a noteworthy transition location among tropical rain forests to north, west, and east and the Chaco type of savanna to the east. Slight inter-stream rises and natural levees bear the principal groupings of trees among which the *cusi* palm (*Orbignya phalerata*) is most abundant, while over the broad flat lowlands in addition grow numerous species from gnarled acacias to solitary arborescent giants. Its interior location places the region among the least promising of the

savannas, but proximity to the rubber-gathering districts to the north gives cattle-grazing considerable importance.

Chaco.—Although the Campos are the broadest and the Mojos plains possibly richest in diversity of trees, of the savannas the Chaco is among the least known and has the most outstanding industry based on trees. A bird's-eye view of the Chaco reveals an exceptional irregularity in distribution of types of growth. Large areas may be wholly grassland, thorn brush, cactus thicket, dense forest, or typi-

Fig. 30. Gran Chaco, Near Puerto Pinasco, Paraguay

Tall grasses and groups of tall bushy-crowned palms are characteristic forms of the Gran Chaco.

cally savanna. Here conditions of soil and ground water have greatly complicated the physiognomy of tree formation (Fig. 30).

Confined chiefly to the south, the *quebracho colorado* (*Schinopsis lorentzii*) and the *quebracho blanco* (*Aspidosperma quebracho*) are easily the most valuable and in their district the most conspicuous elements of the natural vegetation. More widespread are the palms which frequently form extensive groves or *palmeros;* the *caranday* (*Copernicia cerifera*) has the greatest range. The *palo santo* (*Bulnesia sarmientii*) and several mimosas grow over a large part of the west in particular.

THE GRASSLANDS

The South American grasslands embrace the most productive cereal and livestock areas of the continent. By the connotation of the term grassland, the favorable temperateness of these areas is indicated. As in other regions of the world, a considerable part of the grassland has afforded an optimum make-up for the spread of population: ease of communication, easily worked fertile soils rich in humus, healthful climate, and excellent native forage.

Pampa.—Absolutely devoid of trees in much the greater part of its

FIG. 31. AT CERES, SANTA FÉ

Native vegetation on the northern border of the Pampa; a disappearing figure, the Gaucho, who sprang up on the chase of wild animals flourishing on the once abundant natural vegetation of the region.

extent the Pampa is the grassland *par excellence* of South America. About its northeastern and northwestern margins, solitary specimens or ribbons of trees along stream courses may rise above the tall bunch grasses, but in general as far as the eye can reach the only trees visible consist solely of exotic forms planted in the windbreaks or orchards of *estancias*. Agricultural progress has profoundly altered the formation's aspect in most of its expanse, but there still remain large tracts where the true nature of the original Pampa is evident (Fig. 31).

Viewed from a distance, the grass cover seems continuous, but bare ground separates each clump from the next, except in moist spots

where a fine sward may carpet the surface. The principal bunch grasses—*Stipa*, attaining five feet, *Melica*, and *Paspalum*—constitute the *pasto duro*, or original cover, while in moist hollows grows a large variety of softer grasses and flowering plants. In the east particularly, numerous European plants have greatly modified the floristic composition, so that the resultant *pasto tierno* comprises here and there an upper story of the bunch grasses rising above a far more dense growth of various soft gramineae and leguminosae. Also in the east, the scant store of Pampa trees becomes visible, comprising two small forms, the *ombú* (*Pircunia dioica*) and the *ceibú* (*Erythrina cristagalli*).

Alfalfa and the *pasto tierno* have captured a large part of the original *pasto duro* domain and now furnish the forage in the major cattle districts. Nevertheless, it is to the vast pasture of tall, relatively hard bunch grasses that Argentina owes the widespread development of its pastoral industries.

Paraná-Uruguay.—In many respects the grasslands lying to the east and north of the Pampa exhibit close relationship to the western region. The major distinction is in the occurrence of strips of trees along valleys, especially in the east, and of groves of palms and other forms in the west. In addition, the greater warmth of this region produces a grass cover and in consequence livestock industries of poorer quality, though far superior to those of the subtropical savannas.

The species of gramineae are closely allied to those of the Pampa, but they have undergone little displacement by introduced types. Trees attain their greatest development in Mesopotamian Argentina, where in small districts they may compose dense stands. Arborescent species include elements of both Chaco and South Brazil subtropical rain forest types and have most diversity in the marshy tracts of northern Corrientes. The southern portions of the region show chiefly two *algarrobas* (*Prosopis nigra* and *P. blanca*), and the *ñandubay* (*P. ñandubay*), low trees of meagre growth. Northward and notably in Corrientes, palms set in, the *caranday* (*Copernicia cerifera*) and the *yatay* (*Cocos yatay*) being pre-eminent among them.

Patagonia.—In western Patagonia unite almost all of the physical factors individually or conjointly causing grasslands in other parts of the continent: strong winds, moderate rainfall, low temperatures, shallow soils. Hence the region has a predominant grassland character. Trees are rare, and only a few bushes are interspersed with the

grasses. Species of *Stipa*, hard bunch grasses, the *coirón*, clothe most of the area, although in moist swales tender forms prevail. These moist zones or *mallines* greatly augment the forage resources of the far-flung sheep ranches in the south. The extreme southern districts, in Tierra del Fuego, bear in addition a large number of mosses and lichens.

Mountain.—Limited in area and poor in flora, the mountain grasslands nevertheless have special significance to the countries in which

FIG. 32. THE VENEZUELAN "PÁRAMO"

The *páramos*, cold, uninhabited, windy areas of the high Cordillera, support a meagre growth of grasses and few other forms; one of the principal plants is the grey woolly *frailejón* (*Espeletia*) which braves the open wind-swept slopes even to the snow line. (*Courtesy of Herbert J. Spinden.*)

they lie. In the mountain districts where their comparatively well-watered expanses of green pasture clothe rather narrow zones, they furnish an invaluable source of sustenance for livestock, whether in the plateau portion or in the elongated high mountain strip to the east. In the plateau, drier parts, the *ichu* (*Stipa ichu*) and forms of *Festuca* and *Calamagrostis* are the characteristic species of the typical bunch grasses. A relatively coarse-leaved plant, inferior in quality to the grasses of the high mountain pastures, the *ichu* is the chief forage plant of the mountain and plateau region. Abundantly inter-

spersed with *ichu* grass is the cushion-like *llareta* shrub (*Laretia compocta*), an exceedingly valuable fuel stuff on these woodless plateaus. Other cushion forms and numerous rosette-shaped plants add to the natural vegetation of the mountain grassland. In the eastern elevated grasslands of the Peruvian *jalca* and in the Ecuadorian *páramos* few forms other than grasses grow (Fig. 32).

Marsh.—Marsh grassland in South America has considerable economic importance. Of the major areas: Guiana littoral, upper Paraguay basin, southern Paraguay, northern and western Argentina; the first two have developed districts devoted to important agricultural industries. To the Guiana littoral, the grasses contribute little other than offering no obstacles to transportation, but in southern Matto Grosso they account almost entirely for the concentration of stock. As a rule, these tropical and subtropical marshes have few soft or fine grasses. Instead, the high temperatures and plentiful water support a rank growth of tall coarse plants, and on the drier sections rise a few trees.

THE BUSH-LANDS

Though uniformly reflecting the difficult physical conditions of regions permitting only the growth of widely spaced plants, the bush-lands vary considerably in composition. The areas included within the formation comprise some of the leading agricultural districts of the Andean mountains and plateaus, but to these the natural vegetation contributes little.

Humid Mountain.—The bush-lands of the more moist mountain zones are in two major districts: one is inner Bolivia and Peru, the other extending from Ecuador far into Colombia. In the southern subdivision, plants of rosette- or cushion-shape compose the major type of growth. Among these grow various bunch grasses which in certain patches may dominate the stand; relatively tall and erect bushes are rare. Northward, the size of plants increases and on the plateaus of Ecuador and Colombia the shrubs occasionally reach 15 feet in height. In both south and north, the agriculture in the humid bush areas supports an important part of each country's population.

Arid Mountain.—The lower temperatures and lighter precipitation of the western middle Andes over a range of some 23 degrees of lati-

tude are reflected in the pronounced barren aspect of the arid mountain bush-lands. With respect to population, these lands are among the truest deserts of the continent. Occasionally, particularly in the north, humid mountain bush forms enter, but in general the prevailing flora depends largely upon the evergreen *tola* (*Lepidophyllum quadrangulore*) for its average appearance. Grasses, including the *ichu*, a few low shrubs, and various cacti add to the ensemble.

Fig. 33. Along the Rio Negro, Argentina

In the vast wind-swept spaces of Patagonia trees find an abode only in sheltered valleys; elsewhere desert shrub dominates the broad sandstone and lava plateaus. Locate the sheep pens. (*Courtesy of the Buenos Aires Great Southern Railway.*)

Intermontane Valley.—Five minor territories of bush lie near the humid and arid mountain zones, but differ considerably from the higher stands. These comprise: the upper Cauca and Magdalena Valleys, the upper Marañon Valley, the Moyobamba district on slopes tributary to the Huallaga River, and the Santa Ana area on the upper Urubamba River. All of these closely resemble one another; rain-shadow effects or deficient soils give dominance to a generally spiny scrubby flora, as in the Magdalena area. The upper Cauca

Valley contains the most luxuriant vegetation, amounting almost to a savanna, while the bottom of the Marañon Valley lies almost desert. The Moyobamba and Santa Ana districts possess a mingling of evergreen bushes and grasses, all semi-xerophytic in nature.

Patagonia.—In the north, the Patagonian bush formation embraces a broad transition zone in which *monte* and Pampa forms constitute a noticeably important part of the flora. South of the Rio Negro, the stand becomes more distinct and likewise its characteristic worthlessness for grazing. The *jarilla, chañar,* and *algarrobilla,* all found in the *monte* also, abundant cacti, and a proportion of grasses greater than for the *monte* give its salient features to the Patagonian bush-land. Westward and southward the abundance of grasses markedly increases, while on the wind-swept droughty sandstone plateaus all vegetation becomes so meagre as to give extensive tracts of pronounced desert semblance (Fig. 33).

Inner Coastal Desert.—Where the elevation of the western range of the Andes becomes great enough to wring a few drops regularly from the passing winds or where, as in northwestern Peru, a high water table exists, the Peruvian-Chilean desert grades into a narrow zone of xerophilous scrub. The flora comprises numerous cacti, bushes, a few low trees, and a sparse sprinkling of grasses.

THE DESERTS

Including its so-called deserts of sand, salt, or cold—Peruvian-Chilean desert (9A), Lomas (9B), Venezuelan sand dunes (9C), Salt plains (9D), and South Andean glaciers (9E)—South America has less of its area in desert than any other continent except Europe. The largest such portion lies in the Peruvian-Chilean desert (9A), a zone of exceptionally meagre vegetation; in some places only a few lichens prove capable of gathering enough moisture from dew or fog to sustain life. Cacti grow in all sections, while during the less dry season the higher slopes produce a few low herbaceous plants. Trees—acacias and mimosas—are limited almost exclusively to stream-courses or tracts with particularly high water tables. Where the mists of the Pacific yield a niggardly quota of moisture to a narrow coastal zone there exists a strip of noteworthy vegetation—the lomas. Compared to the contiguous desert, the land periodically has a luxu-

riant aspect, flowering annuals mingling with sprouting grasses, shrubs, mosses, and lichens, during an interval of some three months.

NATURAL VEGETATION AND POPULATION

However limited their resources in certain cases, the forests, savannas, grasslands, bush-lands, and deserts of the continent exercise profound influence on the conduct of human affairs in South America. To be sure, the effects of each group have varied in importance with the passage of time. At one period, the mountain grasslands and bush-lands held the major activities of man. At another the zone of tropical rain forest claimed the attention of the world. Today, the great southern grasslands and the productive subtropical rain forests support the principal economic régimes on the continent. Such close adjustment to natural vegetation results largely from the comparative youth of economic development; but despite the inevitable growth in complexity of the problem, the rôle of plant life will long remain highly significant in explaining the distribution of population.

CHAPTER V

TRANSPORTATION

Because of its comparative youth on the scale of economic evolution, South America shows a notably close and easily discernible relationship between conditions of transportation, as influenced by regional character and human activities in the various portions of the continent. Though the parallel may not be carried to extremes, the greater the development of transportation in the several countries the higher the economic status. For example, the A-B-C countries—Argentina, Brazil and Chile—which in foreign trade, economic power and political standing rank first, second, and third respectively, display a corresponding order in railroad mileage.

Though in the case of each of these three, as with all South America, the major geographic bases operative in promoting the expansion of transportation as well as the growth of commerce are easily recognized, they are none the less of outstanding importance. The exceptional ease of building railroads on the Pampa of Argentina has affected all phases of that country's development. Similarly the physiographic nature of Colombia or Peru has placed an unmistakable stamp upon each country. These primary geographic factors have produced striking and significant contrasts among South American lands, in a direct way by facilitating or hindering communications, indirectly by the effects of such ease or difficulty on the human economy. This is illustrated in numerous cases where the problems of reaching isolated or distant localities deter the exploitation of potentially productive areas; examples abound among the countries sharing portions of Amazonia.

Transportation progress within present-day South America depends very largely upon the railroads. Future advance will involve also the airplane and the automobile. But the means of earlier periods will long exercise profound influence, despite their shortcomings. The character of South American lands will preserve for many years the slowly advancing train of laden mules or llamas picking their way

along tortuous trails, the plodding human carrier, or the navigating of unreliable streams by primitive craft (Fig. 34).

Between the continent and the outer world, the meteoric rise of air transportation in coming years will create many new contacts. By this development, two major problems, affecting the early opening of South America, lose much of their significance. To the explorers of colonial days as well as the peoples of the present, these problems—

FIG. 34. DUG-OUTS ON THE DEMERARA

In many parts of South America the Indian and the mulatto are adept at navigating the rivers in small narrow craft; the dense forest stands like a wall in front of land transportation.

the difficulties of approaching and entering the continent—have been a serious handicap.

Difficulties of Approaching and Entering South America.—Though the persistence and strength of the northeasterly trade winds favored early discovery of the northern coasts of South America —witness the voyages of Columbus—approach to other portions of the continent involved weighty considerations. Some of these constitute problems of perpetual significance. First is the distance from world centers of population, especially with reference to the more valuable and temperate lands. Buenos Aires lies 5,870 miles from New York and 6,240 miles from Liverpool, distances covered by the fastest

steamers in 18 and 22 days respectively. Moreover, for several centuries the west coast could be reached only by unusually long and trying voyages. Today, by way of the Panama Canal, this situation has been bettered. Before 1913, an ocean trip from New York to Valparaiso comprised 9,000 miles, to Callao 11,000 miles; now the first measures some 5,100 and the second 3,700 miles. Particularly to the sailing vessels of early days, other problems proved troublesome. The northeast and southeast coasts are long, the winds and currents unreliable and difficult, but the navigation held to the coast rather than brave the unknown expanse of the open sea. As a result, the easterly jutting of the continental mass caused considerable delay in

FIG. 35. HYDROPLANE, BARRANQUILLA

Though hydroplanes afford rapid transit from Barranquilla to Girardot, they do not lessen the freight jams on the great highway.

sailing to points in present-day southern Brazil, Argentina, or the west coast, and still continues to do so.

Once having attained the margins of the continent, the first voyagers encountered additional problems, many of which have in no wise diminished in their retarding effects. This is so particularly in the tropical lands, where swamp, pestilence, and impenetrable forest curb human activities. In addition, few valuable indentations break the coast line, the regular outline giving way to numerous island- and promontory-protected harbors only in the largely unexploitable Chilean archipelago. Few large deep estuaries lead far into the continent, as is the case in more fortunate Europe and North America. Here no drowned river mouths exist to afford such facilities as enjoyed by London or New York. On the east coast Rio de Janeiro's splendid harbor is the result of a purely local development of the Serra do Mar. Elsewhere shallow waters are the rule. Buenos Aires

maintains a narrow channel by unceasing and enormously costly dredging. At the one great indentation on the north coast, Lake Maracaibo, large ocean vessels are kept out by the bar; consequently, freight and passengers for the Lowland are transferred at Curaçao to vessels drawing not more than eleven feet of water. Vessels calling at Georgetown time their arrival so as to cross the bar at the mouth of the Demerara at high tide. At Puerto Colombia only six ships can dock at one time at the mile-long pier extending out into deep water. At the peak of the shipping season as many as twenty vessels may lie at anchor for hours or even days waiting for a berth at the dock (Fig. 35). On the important stretches of the west coast, no indentations compare with those on the east. Only Valparaiso offers docking facilities to large vessels; but even here the open harbor—a characteristic of the west coast—permits strong winds periodically to wreak havoc among craft at anchor or at dock. At every other port, except at the iron ore docks at Cruz Grande, Chile, freight and passengers are lightered from ship to shore, a slow means of transfer.

River Communications.—Compared to Europe and North America, with respect to rivers permitting access to the interior, South America again shows striking shortcomings. The north and east coasts have only four rivers serving as important water highways to the interior, and the west coast has none, the giant Cordillera system limiting navigable stretches of Pacific streams to only a few miles.

The greatest of these natural channels—the Amazon—is without parallel in the world as regards river navigability. But it has widely fluctuating waters, the difference between high and low water at Pará amounting to 30–50 feet, at San Antonio 51 feet and at Iquitos 25 feet; its giant tributaries are all interrupted by rapids or falls near their confluence with the master stream, and the region drained ranks among the less utilizable of South American lands. In all, the Amazon system constitutes the only means of transportation for an area two-thirds the size of the United States. Regular ocean steamers operate to Manáos, nearly a thousand miles from the mouth, and large river steamers continue to Iquitos, Peru, 2,000 miles from the ocean.

The system flowing into the Río de la Plata is inferior in size to that of the Amazon, but in its lower stretches it has acquired an importance which the northern river probably will never attain. Though sand bars, shifting channels, and floating islands hamper shipping,

the various rivers have considerable value, particularly the lower Paraná and the Uruguay. At high water, vessels of 7–9 foot draft may steam for 2,000 miles inland, while the large river ports—Rosario and Santa Fé—can accommodate ocean vessels drawing 20 feet. Eighteen ocean vessels can be accommodated at Santa Fé and forty at Rosario for loading and twenty-five for unloading at the same time. At Rosario 2,000 bushels of grain per hour can be loaded onto ocean vessels.

Few in number and small in size, the rivers of the west coast have only a minor importance. The Guayaquil River surpasses all in

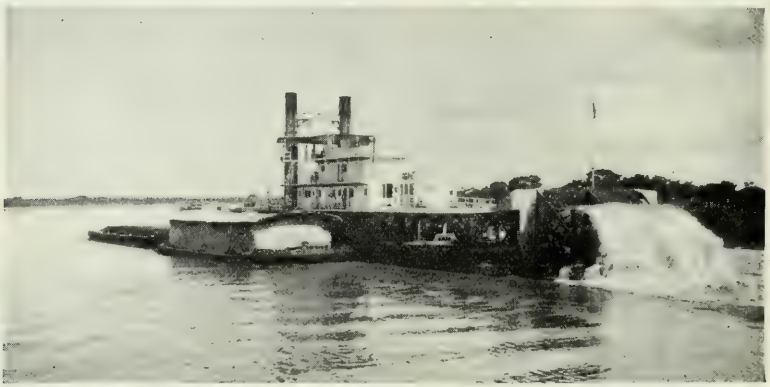

FIG. 36. MODERN FREIGHTER ON THE MAGDALENA

A new oil-driven steamer of the Tropical Oil Company transporting steel and other supplies from Barranquilla to Barranca Bermeja.

navigability, offering some 160 miles of negotiable water to river craft.

The north coast, like the east, has three systems, but of lesser import. The Magdalena has long been the vital artery of movement for Colombia, despite its numerous disadvantages—shallowness, shifting channels, fluctuating levees, and rapids (Fig. 36). Though closed at the mouth by sand bars, it is navigable from Barranquilla for a total distance of 900 miles, but with breaks in transit and great loss of time. Loads destined for Bogotá from Puerto Colombia are unloaded six times and loaded five times in going a distance of 800 miles. Farther to the east the Catatumbo and Lake Maracaibo afford a significant outlet for a portion of Colombia and western Venezuela. The Orinoco, though carrying little traffic compared to other rivers,

FIG. 37

Only three areas in South America possess rail nets. (*From Jones, Clarence F., "Commerce of South America"; courtesy of Ginn & Company.*)

gives the only means of access to an extensive area in the Llanos with much more ease than possible on the Magdalena.

The Railroads.—Only three areas in South America possess rail nets even remotely comparable to those in western Europe and in much of the United States and Canada (Fig. 37). In each case, notable ease of construction coupled with productive agricultural lands has made this possible.[1] But most of the continent offers no such opportunities as those of the Argentine-Uruguay area, the wealthy

FIG. 38. ELECTRIC TRAIN, VALPARAISO TO SANTIAGO

Several parts of South America have fast electric train service; note the almost bare hills of the Coastal Range.

Central Plateau of Eastern Brazil and middle and northern Chile (Fig. 38). Elsewhere lack of resources or great physical difficulties have prevented much expansion; and in such places where considerable stores of wealth have attracted railroads, a heterogeneity of gauges deters the development of an efficient system. Lines of the type built generally to tap enormously productive mountain mining centers have involved herculean labors and represent some of the most striking engineering feats in the world.[2] The construction of such

[1] The Pampa affords a striking example of an adjustment of railway pattern to productive lands. The outer margin of the railway net corresponds closely to the border of the Pampa, wheat and the *monte* on the west and to the Pampa, wheat, corn, and high-grade cattle on the north. Within, nearly every spot is easily accessible to rail transport. Beyond the Pampa the railways fray out into single threads that cross *monte* and Chaco seeking something beyond—A Rio Negro, San Rafael, Mendoza, Córdoba, or Tucuman oasis—see railway map.

[2] Some of these lines include: the La Guaira-Caracas road, which is sure to catch the breath of anyone on the first ride on it; the Central of Venezuela from Caracas to Valencia passes through 87 tunnels in dropping down to the Valencia Plain; the line from Guayaquil, Ecuador, reaches Quito only after scaling the divide at 11,481 feet; the Central Railway of Peru reaches a height of 15,680 feet within 106 miles of the sea after passing through 65 tunnels, over 67 bridges and using 16 switchbacks; the Southern Railway of Peru crosses the divide at 14,688 feet; the Arica-La Paz Railway, after

railways, however, has contributed relatively little to the progress of rail nets in the various countries and practically nothing to international communications, but they are vital to important districts. Routes providing transport between two or more countries have

Fig. 39. Human Porter, Soatá to Pamplona, Colombia
This man for five days carried 65 pounds and kept up with a mule and his rider.

arisen chiefly as a result of governmental policies of national strategy. They include: the several-gauged Trans-Andine between Buenos Aires and Santiago-Valparaiso; the recently inaugurated through services between Buenos Aires and Bolivian points; the through line

miles of cog-track, reaches the divide at 13,986 feet; the Antofagasta-Bolivia at 12,970 feet; and the Trans-Andine, another cog-track, enters the great tunnel at 10,512 feet. No other mountain system on earth has required such engineerinng feats and such colossal outlays of capital to pierce the all-but-forbidden heights with bands of steel.

between Buenos Aires and Asunción; the connecting lines of different gauges from Montevideo to Rio de Janeiro.

Trail and Road.—The paucity of navigable rivers and the restricted development of rivers make a large part of South America dependent upon the carriers of trail and cart road (Fig. 39). On the trails move a volume of trade considerable for the continent as a whole, though

FIG. 40. MODERN ROAD TRANSPORT, BOLIVIA

Transporting Oregon timbers from the railway at Eucalyptus for 60 miles across plateau and high ranges to the tin mill near Caracoles.

minor for particular localities. In the mountainous regions and on the temperate plains, the mule serves as the most common beast of burden. In addition, the llama, the ox, and men carry the produce for many areas. The llama proves invaluable in the higher mountainous regions from northern Argentina and Chile to northern Ecuador; northward it is replaced by the ox and mule, southward by the mule. Human porters characterize much of the tropical low-

lands, wherever poverty or habitat preclude possession of animals or where no satisfactory waterways are available.

For the continent as a whole, cart roads and roads passable for motor cars are surprisingly low in mileage. Among the many handicaps in the way of road construction, some of the dominant ones include the water-soaked forest-covered terrain in the hot humid lowlands, extreme ruggedness of most of the lands in the Cordillera system, and the problem of financing and maintenance in regions of sparse population, such as even the Pampa or in regions of more dense population without a land tax, such as the Valley of Chile. Only about the larger cities have dense nets of roads been made, for here live the users of automobiles. Interurban trucking of merchandise is little developed, owing to the paucity of large cities closely spaced, the lack of governmental funds for road improvements, and the sufficiency of rail service for the time being (Fig. 40).

The Airplane.—Its deficiency in extensive rail or road systems has given South America particular interest in the development of air transportation. While such means of conveyance are restricted by expense to highly valuable goods, they will serve as invaluable agents for the opening of new areas, now almost inaccessible by other carriers, and for the fostering of closer international relations by the expediting of mail service. Every country in South America now has airplane service; Colombia has had such service between the Caribbean Coast and Girardot since 1920. Moreover, New York, Paris, and Berlin already have direct air-mail facilities as far as Buenos Aires and Santiago, by way of various coastal stops. Whereas steamer and rail facilities afford a minimum journey of somewhat over three weeks between the United States and Buenos Aires by way of Valparaiso, the air-mail program involves a trip of less than four days; this is only one example of the great savings in time effected by air service and the tremendous strides the southern continent is taking in the present march of development (Fig. 41).

The rapid spread of airplane services in different areas has increased South America's need for her railroads and motor roads as feeders. It is true that the airplane affords fast spectacular service, but it cannot serve as a carrier of wheat, meats, coffee, oil, or metals. New motor roads are being extended rapidly in the more densely settled areas; rail lines are being pushed into marginal lands to bring new

sections into greater productivity and gauges are being standardized on some important routes.[3] For the benefit of the mainsprings of national wealth, the countries of South America must look to the

FIG. 41

The rapid increase in airways in South America has brought every republic and colony in touch with the most modern means of rapid transport for mail and passengers.

continued expansion of their railroads. With such progress must come about the reduction of dependence upon undesirable river and pack transportation, characterizing so large an area of the continent.

[3] Only recently the Antofagasta-Bolivia Railway eliminated the change in gauge at Uyuni and the line from Girardot to Bogotá at Facatativa.

CHAPTER VI

THE PEOPLE OF SOUTH AMERICA—MAJOR PROBLEMS

In total population and in density per square mile, South America ranks below any other continent (except Australia). Though it embraces more than one-eighth of the world's area, the continent holds only three and one-half per cent of the world's population. By far the greater number of these 75,000,000 people live near the margins of the continent.[1] Huge areas in the interior have remined empty solitudes; deep tranquil tropical forests, barren parched deserts, and rugged cold mountain expanses—nearly one-half of the continent—have considerably less than one person per square mile. No single country of the mainland approaches a density of population like those of countries in western Europe; and the situation will remain essentially the same for many years.

To be sure, South America as a field for emigrants came into the eyes of the world at a comparatively late date, North America lying much nearer Europe and having achieved stable political conditions sooner. On the other hand, the continent had been the seat of great early activity. But in contrast to colonial days in North America,

[1] AREA AND POPULATION OF SOUTH AMERICAN COUNTRIES

Countries	*Population*	*Year*	*Area Sq. Miles*
Argentina	10,340,000 (a)	1926	1,153,000
Bolivia	2,889,970 (a)	1915	514,000
Brazil	39,500,000 (a)	1928	3,285,000
British Guiana	307,400 (b)	1921	89,480
Dutch Guiana	133,561 (b)	1923	54,290
French Guiana	44,202 (a)	1921	34,740
Chile	3,902,000 (a)	1924	289,300
Colombia	5,885,000 (b)	1918	440,800
Ecuador	2,000,000 (a)	1924	220,500
Paraguay	1,050,000 (a)	1922	171,000
Peru	5,550,000 (a)	1921	532,040
Uruguay	1,564,620 (a)	1922	72,153
Venezuela	2,411,950 (b)	1920	393,870
TOTAL	75,578,703		7,250,173

(a) Estimated
(b) Census

here the motives for peopling the land involved no well-defined intention of intensive settling. The effects of this attitude are evident throughout South American history. At first the *Conquistador* entered the continent, but only in mere handfuls. Securing his "El Dorado" in one way or another, he sought only the precious metals. His eyes were closed to the greater resources of the land. Subsequently, however, some recognition of the agricultural value of the new region arose. Various tropical crops began to attract attention and a small movement of population. Settlement by Europeans in the developing of these early areas was hampered by climatic factors, the large importation of slaves, and the unstable political conditions. A third stage of population influx, now in effect, has given South America its nearest approach to a movement like that which brought the Central plains of North America into the van of agricultural production. This flow of people has in its favor: (1) the temperateness of the lands selected; (2) encouraging aid offered by the republics; (3) existing sparsity of population and most stable political conditions. That this most important mode of increasing population will assume greater importance is likely, but a series of obstacles will delay its certain benefits. The principal obstacle concerns the difficulty and expense of obtaining land, in consequence of which the distribution of peoples for most parts of the continent shows a disquieting concentration of people in the cities. Agricultural areas still show a sparsity of population, detrimental to the progress of the continent and in view of the years of white occupation not even remotely commensurate with the potentialities of these lands.

DISTRIBUTION OF POPULATION

Where have the major centers of population arisen and why? Except in the tropical northwest, where the heat of the lowlands has kept population to the mountains, man has held close to the sea (Fig. 42). Near the sea have grown the great hubs of denser population and there gather the chief groups—about Rio de Janeiro, Buenos Aires, Santiago, and Lima. About these zones the parcelling of land resulting from increase in land values has permitted a density of from 30 to 60 persons per square mile in the temperate southern lowlands and northern highlands. In northeast Brazil, the density reflects the early importance of the tropical agricultural areas and the former use

of large numbers of slaves. Each of these districts showing a considerable population indicates the productivity of the land in an

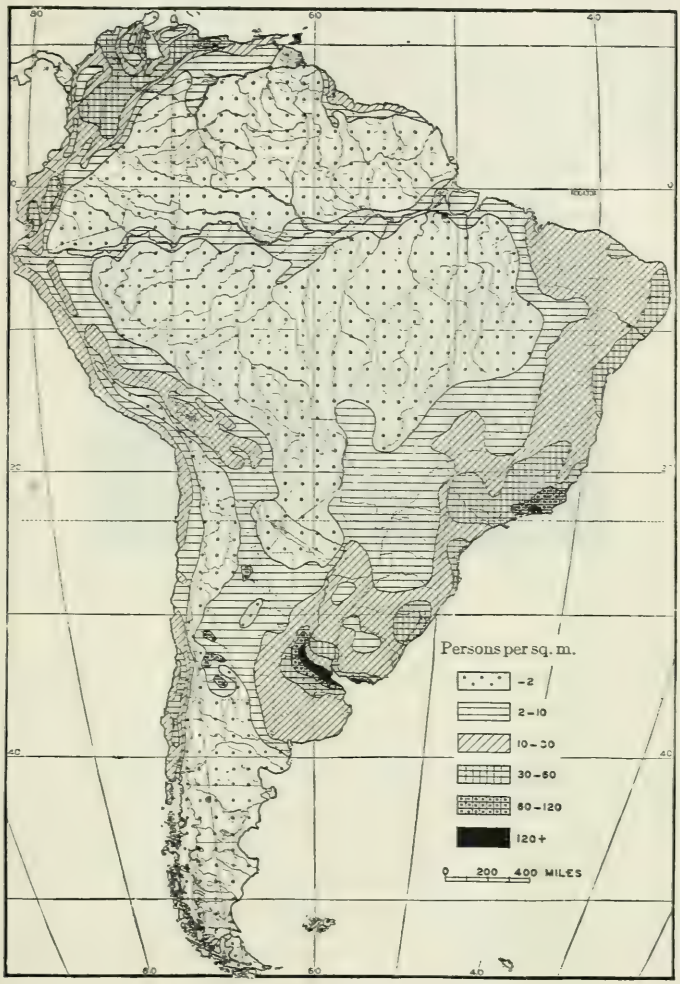

FIG. 42. POPULATION DENSITY

Most of the people of South America have concentrated in areas near the sea or highland sections in the tropics.

agricultural economy based on the raising of crops, favorable contacts with sea and adjacent lands, and consequent financial and commercial activities.

A second group of comparatively dense population embraces: the cattle lands of the east, from the southern Pampa to the northern *sertão;* the various farming districts of the Pacific slopes; and the mixed agricultural sections and mining centers of the Central Andes. Among these areas the tendency to live in large cities is absent, in the cattle lands owing chiefly to the nature of the major activities, in the second group because of limited resources, and in the highlands as a result of the close adjustment of the native to his land and the

Fig. 43. Angaité Indians, Gran Chaco
Backward Indian folk occupy great stretches of tropical South America.

inability of mineral developments for export to bring about great concentrations of people.

The cooler dry portions of the continent and the expansive heated interior hold a negligible sprinkling of people (Fig. 43). In the northern lowlands, the rivers serve to mark out the areas of heavier population; the encircling forest is penetrated only by the gatherers of forest products, while the savannas afford little protection from marauders and possible markets are few. The cooler lands support for the most part the shepherd and the miner, men not seeking to further the cause of their particular territory in any special direction, except to increase the output of wool, mutton or minerals to be manufactured and consumed in foreign lands.

COMPOSITION OF POPULATION

Whereas scantiness of population is a grave problem confronting most of South America, in some parts the type of present inhabitant

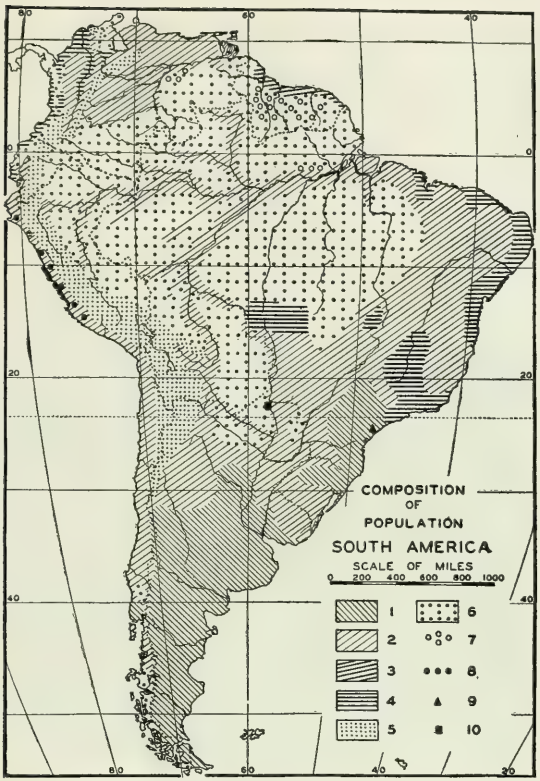

FIG. 44. COMPOSITION OF POPULATION

(1) A population largely of European extraction—Indian and mestizo being replaced primarily by European immigrants during the last fifty years; (2) Spanish-Portuguese-Indian mestizo. The proportion of European blood varies greatly from a large fraction in the Central Valley of Chile and Antioquia, to only a sprinkling in the upper Amazon, eastern Paraguay, and the inner Llanos; (3) British, Dutch, French—mestizo with a strong proportion of negro blood; many Hindoo and Chinese immigrants; (4) Mixed population of Indians, Europeans and negroes. The proportion of European blood varies from a significant fraction in East Central Brazil to almost nil in the Pacific Margin of Colombia; (5) Population dominantly Highland Indian and mestizo with a small fraction of European blood; (6) Pure Indians, or almost pure Indians, living in primitive conditions and largely apart from the influences of the republics; (7) Bush negroes little mixed with Indians living under primitive conditions; (8) Negro and Oriental blood introduced during the guano period; (9) Recent Japanese immigrants; and (10) Mennonites in Paraguay.

brings up even greater difficulties. In view of the present low productivity of the areas where the composition of population is least favorable, this is a vital consideration, especially for the central and north Andean states. The problem resolves itself largely into that of the Indian and the mestizo, for these two types compose 90, 86, 94, 90, 90, and 97 per cent of the populations of Bolivia, Peru, Ecuador, Colombia, Venezuela and Paraguay, respectively.[2] In Argentina and Uruguay, where the white elements total nearly nine-tenths of the population, the problem is non-existent; while in Brazil and Chile, where whites constitute twenty per cent or more of the aggregate, it is not so acute (Fig. 44).

Indian and Mestizo.—The plight of the Indian and mestizo elements in South America since the first days of the conquest has formed one of the darkest pages in the history of most of the continent. Always a troublesome matter, today, in view of the progress of countries free from the problem, it becomes a notable concern for most of the republics. How to better the life of the lower classes and mold them into a progressive enlightened people and utilize available natural resources to full advantage, has occupied the minds of South American statesmen for many years. In its many implications, the difficulty involves enormous changes requiring the overthrow of centuries of binding tradition and custom.

In Peru and Bolivia, the question of the Indian has claimed greatest attention. Here at the time of the first Spanish arrivals, the Quichua

[2] The Composition of the Population of South American Countries in Percentages

Countries	*Native Indian*	*Mestizo*	*Negro Zambo (a) Mulatto*	*Asiatic*	*European*
Argentina	2	10 (b)			88
Bolivia	50	40			10
Brazil	15	30	20		35
Chile	5	65			30
Colombia	15	40	35		10
Ecuador	65	23	5	1	6
Paraguay	97 (c)				3
Peru	50	35	1	3	10
Uruguay	2	12 (b)			86
Venezuela	11	70	9		10

(a) Cross between native Indian and negro.
(b) This figure certainly is too small.
(c) Indian and negro cross.

and Aymará Indians possessed an amazingly advanced civilization in the light of times. The Inca empire, of which they formed a large part, had developed a careful and highly productive agriculture, in which the greatest skill was employed. Irrigation works built before the sixteenth century continue to serve the widely terraced slopes of the land. The farmers raised corn, potatoes, and cassava, among others, and artisans utilizing many minerals produced admirable work. These were a powerful and justly proud people. Yet a handful of Spaniards carrying firearms and arriving at a period of internal

Fig. 45. Aymará Indians, Bolivia

In the valleys many huts are made of stones but on the *Altiplano* and *pampas* they consist of thick adobe walls. (*Courtesy of L. D. Gismondi.*)

strife soon reduced them to virtual servitude. Ruthless domination in the succeeding centuries bred an inherent tendency towards a pathetic resignation to the burdensome conditions of both their environment and their mode of life. As a result there has developed a hard-working class, accomplishing little, contributing only involuntarily to national advancement, and almost unable to receive help, owing to illiteracy and a philosophy of passive submission to whatever may befall them. In the effort to attain greater comfort, the temporary solace of cheap intoxicants or deadening coca proves more attractive than group organization for common aid (Fig. 45).

In the Andes of the north, in Colombia and Venezuela, the lot of descendants of the Chibchas is slightly better. This group, too, had reached an advanced stage of development and also has fallen far.

Here, however, a more generous region and a somewhat more sympathetic attitude of the dominating classes have given the Indian greater ease in life, though his existence is by no means an enviable one.

Conditions affecting the natives of the Llanos, the Amazon, the Campos, the Brazilian Highland, and the Chaco differ by far from those bringing about the situation in the Andean Highlands. The

Fig. 46. The Araucanian

Sturdy Indian stock that has contributed greatly to the formation of a high-class mestizo in Chile. (*Photographer unknown.*)

population is meagre and contact with the destructive influence of the European has been less extensive. Many Indian tribes still live in absolute independence, especially in the Amazon Region. Early exploitation to supply slaves and later to maintain mines and forest industries decreased the natives considerably, but inasmuch as these activities affected only the small unconnected groups there has arisen less of a problem. Moreover, the Indians had not attained the stage of civilization common to those in the western part of the continent. Only the Quichua and Aymará Indians of the Inca Empire and the

Chibchas of Colombia and Venezuela showed advanced civilizations when the Europeans came. Most other Indians of the lowlands included numerous groups, many of whom had not reached the Old Stone Age; many of them had neither tribal groups nor hereditary chiefs; they lived the life of the pure savage of nature.

The southern lands, because of the mode of life of the aborigines, show much different relations of introduced population to native inhabitants. In the case of much of Argentina and of Uruguay, the Indian problem was solved for all time by the virtual extermination of the fierce natives. The Indians, nomads of the vast grassy plains of the Pampa, had no centers of civilization which the invader might appropriate; they refused to be subjugated, and the net result was warfare to the finish. As for the Chilean Indian—the Araucanian—he alone has withstood, and even repulsed, the onslaught of the European. His protection by the forest and his great virility have given him a sturdy semi-independence (Fig. 46). Rather than bowing to the newcomer, he forms an important element of the Chilean people, and is slowly being assimilated. The Indians of Tierra del Fuego form a third southern group; fisher-folk or huntsmen, they have little to attract commercial cupidity. Living in small groups or families, they are gradually disappearing.

Introduced People.—That the Spanish language is the common tongue of nine of South America's ten republics suggests the degree to which Spanish institutions influence the present-day continent. Yet, descendants of the Portuguese have control, in one great republic, of nearly half the continent. Early taking possession of the larger and western part, for centuries they were the only Europeans to enter these new lands. Soldier and missionary brought Spanish dominion to a huge area, and by military or religious conquest established the preeminence of the mother country. Though the first arrivals sought chiefly quick wealth, they paved the way for a later influx of settlers, who intermarried with the Indian and gave rise to the mestizo element. As a rule, the enslaving of the Indian had freed the newcomer of any need for manual labor, and the characteristic disdain for hard work was increased, to the everlasting harm of the new lands. In Argentina and Uruguay, no Indians being available, such has not been the case. Elsewhere the huge land grants and the life of ease created a sort of indolent aristocracy which has markedly retarded

progress in several countries. Between these representatives of the "froth" of society and the mestizo or Indian lies a hitherto unbridgeable social, political, and economic gap. Upon the closing of this break depends the future welfare of much of South America, an evolution that will come about only in slow and trying steps. In some areas it will mean the complete elimination of the lower classes and their replacement by a new.

Brazil's occupation by the Portuguese, the enslavement of the Indians, and the importation of large numbers of African slaves brought about another but less complex problem. Fortunately for the comparatively populous east from São Paulo northward, the negro has proved assimilable to a high degree. Moreover, this is a rich expanding country of many opportunities and the lower groups can obtain some land. Portuguese and mestizo, negro and zambo (descendants of negro-Indian cross), here have effected an apparently strikingly harmonious blending of peoples. That the blending is to the advantage or detriment to the nation remains to be seen.

In numbers, the third largest foreign group in South America is the Italian. Argentina and east central Brazil hold most of these. They have found here a congenial land where live their own kind and the Spaniards, the latter in temperament closely resembling the inhabitants of the crowded peninsula of the Mediterranean. Blood brothers of the earlier settlers, they master the language soon and blend with the people during the first generation.

The Germans constitute a fourth important European group in the spread of settlement over South America. They form progressive colonies in southern Brazil and southern Chile, in both districts preserving the essential tracts characteristic of the homeland.

In addition to the Latin races, the Germans and large numbers of English commercial men, major population groups are those of Japanese and Chinese residing in Peru and Brazil, and of the many imported laborers from East India and Java in the Guianas and Trinidad; the orientals settled in response to certain climatic and agricultural conditions, with the aid of governments in question.

PROBLEMS OF POPULATION AND THE FUTURE

Population problems of one kind or another closely affect practically all of South America. In general, these questions fall into five major groups, viz., those concerned (1) with class distinctions, (2)

with systems of land tenure, (3) with lack of sufficient funds by the different governments, (4) with education and sanitation, and (5) with immigration.

In those countries where the gap between upper and lower strata is widest, geographic conditions promise a long maintenance of the situation. The wretched life of the common masses, a life imposed generally by the difficulty of communication in a poor and highly

Fig. 47. Upper Class People, Medellín, Colombia

An artisan class, in general far removed socially and economically from the mass of the population.

broken country, over much of which an unfavorable climate reigns, augments the feeling of innate superiority entertained by the ruling groups (Fig. 47). No bond of sympathy has grown up between those whose life embraces a maximum of luxury and those whose only luxury comes from stupefying liquor or drug. To help the latter would mean the taking of vigorous steps toward improvement in agricultural methods, in transportation, in education, and in many other directions; but such steps would also involve certain sacrifices in ease of living and these the upper classes have been unwilling to make. In the more densely populated areas of the temperate lands,

the case is somewhat different, for by their concentration in cities and their opportunities for education and organization the mestizos and, to a lesser degree, the Indians advance in power.

Prevailing systems of land tenure in many areas tend to emphasize the problems of class distinction. During the colonial period and the early days of the republics influential persons were successful in getting control of vast areas of land in most sections of the continent. Even in Argentina, where the composition of population is highly favorable, the retention by relatively a few of great blocks of the best land has done much to hinder the development of a beneficial national unity. In the Andes, the situation far overshadows that of Argentina in influence; the Indian of the *Altiplano* of Bolivia, for example, lives in virtual serfdom and forms as much a part of the property as the soil. In Brazil from early days to the present the vast estates and *fazendas* have been the basis of economic organization, though members of the lower class may obtain land if they have the initiative and can accumulate the wherewithal. In Chile about 7 per cent of the population controls all the good land. Denial to the lower classes of the right to own land or of the possibility of acquiring it by settlement will long keep the problem of land tenure a sore spot in the make-up of most South American republics.

Of all the problems facing the South American peoples and republics, the lack of funds for most lines of development has been a pressing one. As a result primarily of the prevailing system of the distribution of the major source of wealth, the rich farms and pastures, all the countries have been poor financially. The owners of the land, in control of the government machinery in most cases, have not seen fit to place a heavy export tax on the products of their lands; neither have they been willing to place even a small property tax on the land that would be a burden to the vast expanse of unused land and inevitably force the huge holding to disintegrate. As a result of this policy most countries have had to look to foreign sources for capital for most all lines of development. Many of the railways and most of the mines of the continent are owned outright and even operated by foreigners.[3] Port improvements, highways, public utility services—

[3] In the foreign-controlled railways are nearly one-half the railways of Argentina, the São Paulo Railway, the most important single line of Brazil, the Central of Venezuela, the Central and Southern of Peru, the Antofagasta-Bolivia Railway, and many minor lines.

water, light, and sewage—of the large cities, and even the street pavements have been accomplished by floating loans in foreign lands. Even the banking system consists chiefly of foreign branch banks and personnel. The extent of this handicap of lack of funds is expressed in the figures of foreign capital invested in South America. Recent estimates place the totals as follows: United States of America three billions, Great Britain five billions, France one and one-half billions, and Germany one and one-fourth billions.

The spread of education is a prime requisite everywhere. None of the countries has a literacy of over 65 per cent; most of them less than 25 per cent.[4] Where communications are poor and funds lacking, which are widespread conditions, enlightenment becomes a herculean task. The inability of so many to read delays all progress in the spread of improved agricultural methods, sanitation, and general living conditions. Malaria is common in most tropical areas and the average person does little to prevent its ravages. Hookworm is a menace; the percentage of hookworm infection in several areas stands astonishingly high (Fig. 48).[5] Only in Chile, Argentina, Uruguay,

[4] According to the most reliable statistics and estimates the illiteracy in South American countries is as follows:

Country	*Year*	*Per cent of Illiteracy*	*Remarks*
Argentina	1922	35.1	Of the total population over 7 yrs.
Bolivia	1918	80.	Only 54,000 children in school.
Brazil	1920	80.	1,240,440 pupils in primary schools.
Chile	1907	60.	
Colombia	1918	82.	Only 361,000 pupils in school.
Ecuador	1922–23	84.	School attendance 101,370.
Paraguay	1923	88.	70,820 pupils in school.
Peru	1920	78.	194,701 pupils in school.
Uruguay	1923	40.	120,580 pupils.
Venezuela		80.	

In the light of these percentages it is interesting to think of the figure for the United States of America—6 per cent.

[5] Hookworm Infection in South American Countries

Countries	*Percentage of total population*
Brazil	77.3
British Guiana	61.8
Colombia	92.3
Dutch Guiana	93.1
Paraguay	90.
Venezuela	80–90.

Compiled from reports of the Rockefeller Foundation.

and southeastern Brazil, where immigrant populations have recently brought with them European institutions, does education and sanitation make much headway.

In those areas, generally of least attractive physical conditions, the troubles arising from class distinction, manner of land tenure, and lack of education are most serious. Consequently, the immigrant finds a convincing set of arguments against settling in those countries. As a result, such sections of South America which might profit most by increased immigration have the least chance of securing it. Incoming population also steers clear of the tropical lowlands, where

FIG. 48. DUTCH GUIANA CHILDREN

Six children in one family, all heavily infected with hookworm. (*Courtesy of the Rockefeller Foundation.*)

climate, insects, diseases, and social classes preclude their settling at the present time (Fig. 49). Though yellow fever has almost been eradicated from South America, hookworm disease has decreased greatly, and malaria controlled in special places by the activities of one organization or another, it is still a muted question whether white man with his science and knowledge can create over vast portions of the hot humid lowlands comfortable and healthful places in which to dwell. It is the A-B-C countries and Uruguay only that have enough power to attract the permanent resident, for with the reduction of immigration quotas into the United States these southern lands are among the more desirable parts of the world for the majority of European emigrants. There they may find a climate more or less similar to that in Spain or Italy, whence come the bulk of the new arrivals, and there also live many others of their countrymen, uncolored by the "tar-brush" of the more tropical lands. Limiting their

interest, however, is the pronounced difficulty of obtaining land. Moreover, industrial activity in the large cities is not yet great enough to absorb heavy influxes of foreigners and will not become so unless opportunity for growth is afforded the rural districts.

South America constitutes one of the World's greatest areas producing large surpluses of commodities for international trade. It contains the largest amount of relatively undeveloped good agricultural land. Owing both to natural conditions and the barriers imposed by present inhabitants, the continent realizes only a small part

Fig. 49. The Retreat of Yellow Fever in Tropical America
(*Courtesy of the Rockefeller Foundation.*)

of its potential productive power. The persistence of the numerous shackles affecting South American progress points to a perpetuation of this situation of frustrated capability. Frequency of political upheavals indicates the restlessness induced by the enumerated problems. Were the energy so expended devoted to other than petty aims of personal aggrandizement, South America would be far beyond its present status; but many of its public men have not been so minded. Rather will the long accumulated undercurrents of economic pressure straighten the various perplexities, possibly by a tremendous and sudden overthrow of present encumbrances through well-organized revolution, or by slower, less evident changes to be induced by the interests of foreign capital and viewpoints in developing the huge resources of the continent.

CHAPTER VII

THE FALKLAND ISLANDS

Possibly less distinctively South American than any other portion of the continent and its associated territories, the Falkland Islands possess a significance out of all keeping with their individual natural resources. Lying as they do in the South Atlantic 1,000 miles south of Montevideo and 480 miles northeast of Cape Horn, remoteness dominates the life of these frontier stations. Communication with the world depends primarily upon a monthly service provided by English steamers which call *en route* to Punta Arenas and the west coast of Chile and also on the return voyage. Commodities produced on the islands do not justify even this slender service. However, as the sole suitably strategic location commanding the Magellan Strait route, and as a provisioning point for the principal whaling industry of the world, the islands acquire a unique importance in these waters of the South Atlantic. Coal and coke compose 50 per cent of total imports. The operation of two wireless stations on the islands indicates their value as key locations.

Population lends additional color to the characters peculiar to the islands. Peopling the land to the extent of less than one-half inhabitant to the square mile, an exclusively white settlement has developed. Of the 3,500 settlers, one-third live in Port Stanley, the largest community of the islands. The physical resemblance in many respects to areas in northern Scotland is emphasized further by the preponderance of sturdy descendants of the Scotsmen who succeeded the original population of Argentine *gauchos*. A Norwegian element, concerned with the whaling industry, composes a minor part of the total. Life is hard and drear on the bleak rolling moorland and only those needed for maintenance of facilities offered by the islands remain. A not inconsiderable portion of the communities is derived from the crews of foundered ships—men who have sought release from the rigors of whaling in the stormy wastes of the South Atlantic.

Since early days of European activities on the continent, the

strategy of a base in the Falkland Islands has made the group a bone of contention. Their discovery by the English in 1592 came too early to cause much interest in their retention. In a century and a half the importance of the west coast of the continent had become so great that in a period of less than one decade a spirited manœuvering for their possession ensued. France took the islands in 1763, relinquishing its hold two years later to Spain, which valued them as a possible victualing point for vessels destined to Chile and Peru. Whereupon the English established a garrison on West Falkland. After a period of military jockeying, interest in the islands waned, only to revive again in 1820. At this time the young ambitious republic of Argentina decided to avail itself of an important frontier port. The wealth of neighboring seal fisheries resulting in a controversy with an American ship of war lost the island to Argentina in 1831. This long series of exchanges reached a pause in 1832, when Great Britain repossessed itself of the islands.[1] Of late, dispute has arisen again, despite the century-long control by the Empire, for Argentina has made many claims concerning its rights to the islands or some of the dependencies.

PHYSICAL CHARACTERISTICS OF THE FALKLANDS

The Falkland Islands, East and West Falkland, and approximately one hundred smaller ones, comprise an area of 6,500 square miles (Fig. 50). About the size of the Hawaiian group, where balmy tropical air and fertile lava soils of these modern Islands of the Blessed support a population of a quarter of a million, the bleak, treeless, rolling moorland of the Falklands give poor subsistence to a scant population of 3,500 souls.

The Surface of the Land.—The surface, devoid of tree growth, consists of severely glaciated rolling topography interspersed here and there with gray rock ridges or rugged hills, which rise to a height of slightly more than 2,000 feet. In places, extensive peat bogs have developed, while in others over-grazing of native grasses by sheep has caused dominance of the terrane by drifting sands.

[1] In 1908 and 1917 the Falkland Islands Dependencies were created by Letters Patent. The Dependencies include the islands and territories between 20° and 50° W. longitude south of 50° S. latitude and between 50° and 80° W. longitude south of 58° S. latitude, notably including South Georgia, the South Orkneys, the South Shetlands, the Sandwich Islands, and Graham Land.

A highly articulated fiorded coast has played an important part both in domestic and foreign intercourse. Port Stanley, on East Falkland, developed about an almost land-locked harbor of ample depth.[2] Moreover, a multitude of minor natural harbors are available to ships seeking shelter. The ease of movement by boat from

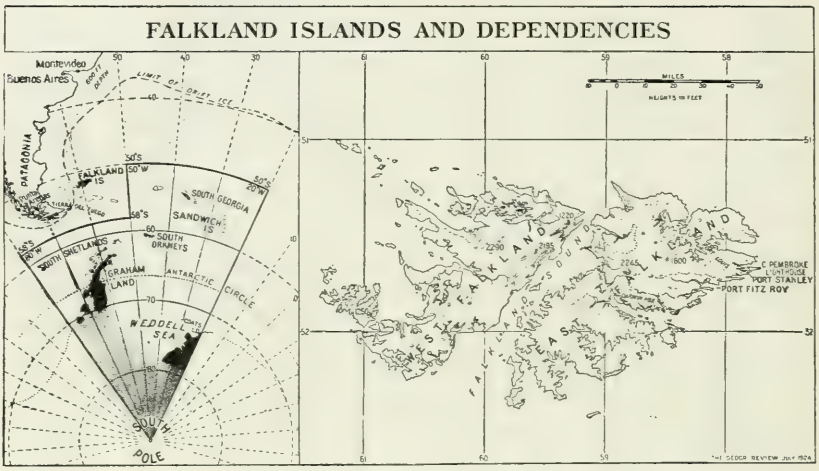

Fig. 50

(*Courtesy of the American Geographical Society.*)

one point to another and the difficulty of traversing the interior morasses make the sea the principal local highway. Absence of tree growth and the lack of a local fishing industry differentiate these islands of sea-faring peoples from other parts of the world where a well-indented coast, near-by fishing banks, abundant wood, and meagre agricultural resources have contributed to an outlook towards

[2] Stanley Harbor, a noble stretch of 3 miles in length and one-half mile across, entered through the narrows from Port William, which effectually protects the harbor in all winds, is the hard-gained refuge of many a sailing ship, battered and smashed by the winds and seas off Cape Horn; there is seldom a week when one of these "lame ducks" does not find its way into the harbor to be refitted and repaired for further voyage or to be condemned and remain as one more of the many victims of the sea lying there. Amongst others are the *Great Britain*, famous in her day as the first iron steamer, and the *Snow Sproll*, which took refuge here from the *Alabama* in the days of the American Civil War and found a permanent home in this last resting place of so many "lame ducks" from the Cape Horn seas.

Port Stanley lies on the south side of the harbor and consists of one main street along the water front and a couple of small streets behind. Most of the older houses are simple white wooden structures, but the newer ones are built of sandstone.

the sea peculiar to such regions. There are no roads and overland communications are reduced to a minimum.

The nature of their soils gives these lands an additional factor fostering the dominance of interests other than the tillage of land. Cold and damp, the ground yields grudgingly such crops that climate may permit. The cultivated area comprises only 150 acres. Wheat will not ripen at all, and barley and oats, the chief crops, rarely mature properly. Vegetables can be produced only with difficulty, milk and dairy products are hard to procure, and fresh vegetables, even cabbage and potatoes, are largely a luxury. Most of the foodstuffs required by the islanders are imported. Grazing by sheep and a few cattle and the gathering of peat constitute major exploitations of soil resources.

Climate.—Climate exercises the major influences in conditioning human economy. Without the arbitrary worth of the islands as a way station, this one factor would retard effectually any occupation of the land. The group lies in a belt of extraordinarily persistent storminess. Cyclones follow each other in quick succession, so that rain falls on 243 days of the year; snow is scant in quantity. The annual total of precipitation, however, reaches only 20 inches, for the rain occurs generally in drizzles or light showers; fog occurs on one day in six. The monotony and discomfort of a climate such as this are accentuated further by the correspondingly small amount of sunshine and the uniformly high relative humidity. The cold Falkland Current which washes the shores keeps temperatures low and the marine influence prevents wide fluctuations. In general, the warmest month, January, has an average temperature of 49° F; July, the coldest month, 37° F. Summer maxima may reach 73° F and winter minima drop to 22° F. When added to frequency of precipitation, paucity of sunshine, humidity of atmosphere, and the low temperatures, the cold strong winds, prevailingly westerly, complete a set of climatic hindrances with few parallels in similar latitudes. Not only absence of tree growth but even the gait adopted by the islanders in walking denotes the dominance of such winds.

Biotic Resources.—A further indication of the general uniformity of uninviting physical conditions, types of both native vegetation and animal life number few species. The scantiness of other resources has led to the extensive utilization of the available native life, the inhabitant eking out much of his daily diet indirectly from plant growths,

by the pastoral industries, and directly from colonies of birds, by gathering quantities of eggs (Fig. 51). Seals formerly afforded a considerable industry, but ruthless methods resulted in the extermination of all valuable kinds.

Occupation of the islands has altered natural vegetation. Tussock grass (*Poa flabellata*) supported an early cattle-grazing development of great value. The nutritious plant was an ideal food, but overgrazing eradicated it on all of the larger islands. Only on various islets does it grow in quantities sufficient to furnish a worth-while source of hay. At present, the typical growth consists of grasses far

FIG. 51. COLLECTING PENGUIN EGGS, KIDNEY ISLAND

Penguin eggs constitute a significant source of food. (*Photo by Rollo H. Beck; courtesy of the American Museum of Natural History.*)

less suited to grazing, although the sheep industry maintains a relatively large number of flocks on the usual pasture, wherever moss-covered bogs or drifting sands do not claim the land. On this meagre basis, sheep-grazing has become the premier industry of the Falklands.

The millions of penguins occupying the margins of the islands furnish much to the local supplies of food. So important is this resource considered that various regulations control the gathering of the eggs. Early recognition of the necessity for such action prevented the destructive exploitation characterizing the history of seals and grazing facilities in the islands.

Though the whaling industry of the Dependencies of the Falkland Islands supplies the bulk of exports from Port Stanley, fishing in-

dustries about the Falkland Islands proper have not attained more than negligible importance. Physical conditions of the sea between the group and the continent suggest the likelihood of a potentially substantial fishing industry. The depth of banks permits operations. Sea temperatures correspond to those of fisheries in the North Atlantic. The presence of great flocks of birds presupposes the existence of quantities of fish, and the appearance of small schools of fish in the inlets of the islands suggests the presence of a rich source of food untouched. Two factors, however, delay the incipience of such industry: the lack of a population naturally inclined towards that kind of sea activity and the lack of suitable timbers for fishing vessels. Rather than change his occupation, the island herder migrates to Patagonia or South Chile, where grazing land abounds.

HUMAN ACTIVITIES

The Grazing Industry.—Grazing in the Falkland Islands has experienced two boom periods, an earlier connected with cattle, that coming later with sheep. From the original nucleus of animals which escaped from the enclosures of lands held by early French settlers in East Falkland, grew a herd of wild cattle numbering some 30,000 head. Lack of shackles imposed by man and the abundance of the tussock-grass, during the period following first interest in the islands, permitted this increase. Magnificent animals, the cattle soon came to be known as a source of food for whalers. The men simply landed with supplies of salt, killed the animals, and prepared enough beef for their long voyages. Hides were ignored. As this resource drew more attention, an industry like that of the early days in the Argentine Pampa arose, in which *gauchos* hunted the herds. Subsequently, under English management, came salting of meat for export. Decimation of herds and eventual over-grazing led to the final decline. The islands now support less than 6,000 head, some of which continue to run wild.

For many years the principal industry, the raising of sheep now engages two-thirds of the population.[3] Some thirty enterprises control almost all of the available land. Owing to the low carrying capacity of the ranges, ranches are large, reaching a maximum of

[3] Sheep introduced into the Falkland Islands in 1867 increased rapidly until 1896, when the numbers totalled about 800,000

700,000 acres. The prevailingly raw, windy, and moist climate permits the production of only hardy sheep of cross-breeds, here predominantly Romney Marsh in characteristics. Almost 700,000 of these animals browse on the rolling grasslands, a figure 100,000 less than the total for 1896, when the industry reached its peak. Climate takes heavy toll among the sheep, for the damp ground induces the commonly fatal foot-rot. Improvement of breeds becomes constantly

FIG. 52. A SHEEP STATION, WEST POINT ISLAND

Stations border the coast as all communication is by water. (*Photo by Rollo H. Beck; courtesy of the American Museum of Natural History.*)

more urgent. On the other hand, climate contributes to the production of a fleece of exceptional quality. The fiber has fine texture and light specific gravity and commands high prices to be used especially in high quality hosiery and finger-yarn articles.

As a rule, each of the large ranches supports a settlement situated on one of the numerous good harbors. Here are assembled various habitations, wool sheds, and the sheep pens. The huts of the shepherds are scattered about the adjacent property. In many cases, a ranch includes an entire island (Fig. 52).

In a land producing so few other commodities, the sheep industry becomes of prime importance. Not only does the major portion of

the population depend upon it for income, but mutton is the only plentiful food obtained from the islands. Dairy products are scarce, vegetables largely luxuries. In addition to providing sustenance to the inhabitants, the herds furnish raw materials for two small mutton-canning factories, help stock ranges on the continent in surplus years; and wool accounts for a scant 5 per cent of the total value of exports (1928).

The Whaling Industry.—A sphere of influence extending for 1,000 miles or more from Port Stanley into the seas of the Dependencies, results in the dominance of whaling products in the export trade of the Falkland Islands. The striking relation of the Dependencies to the Falkland group illustrates again the advantages afforded by the position of Port Stanley. Here the whalers can obtain coal and provisions of food, make repairs, rest from the strenuous life in the far south, and profit by constant communication with Europe.

Norwegians in pursuit of their ancestral occupation carry on most of the whaling. They have settled about Port Stanley and from that base have established temporary colonies in South Georgia. As a whole, the industry engages some 600 men at Port Stanley and a possible 1,000 on Antarctic shores during the active season.[4] Owing to remoteness of fishing grounds and the need for considerable equipment, large enterprises preponderate.

The industry in its present proportions dates from the beginning of the twentieth century. Previously the whalers exploited only the sperm, bowhead, and right whales. The introduction of steam vessels and the harpoon gun in the industry enlarged the scope of development enormously, for with them the capture of the abundant humpback and finner species became practicable.

In general the summer months (October to March) witness the chief whaling operations, though even in this season the ordinarily inclement weather proves highly disagreeable and often dangerous. In the south of the fishing territory, proximity of the ice pack limits the season to less than three months. Floating factories, as well as several land stations on South Georgia, controlled either from Port Stanley or directly from Europe, render the valuable oil and convert bones and meat into a fertilizer compound.

[4] South Georgia, the chief seat of much of the whaling operations, has a population of 1,895 souls of whom only 7 are women (1926).

Commercial Contacts and the Future.—Statistics of commerce accentuate the unique rôle of the Falkland Islands. Owing to an industry pursued a long distance from its confines, the group holds world pre-eminence in total foreign trade. For each person in the Islands and their Dependencies trade registers more than $4,500 annually (1926), a figure exceeding by far per capita trade for any other commercial unit in the world. Exports compose more than 80 per cent of the total, attributable principally to whale products, in the main, oil. In value, whale products ($20,000,000, 1926) surpass the total export trade of a country such as Paraguay by almost 70 per cent. The financial status of the inhabitants denotes to a significant degree the wealth passing through the islands. The average bank account totals more than $600 and a Poor Fund founded by a philanthropist procures no solicitations for aid. The hard life breeds thriftiness and the basic element of population has lived thus from time immemorial.

Imports amount to one-sixth of the commercial movement. Despite the need for foreign foodstuffs, a mineral commodity comprises one-half of total purchases. Since no coal or wood is available directly, and the atmospheric humidity prevents complete drying of peat, coal and coke are major necessities. The climate demands heat in habitations throughout the year. In addition the supply of fuel meets requirements of vessels that coal at Port Stanley, of mutton-canning plants, whale factories, and ship-repair works. Foodstuffs, manufactured metal wares, and wood compose most of the other imports, and reflect the poverty of the islands in conditions conducive to a well-balanced economic existence.

Sheep ranges stocked to capacity, gardening possible only on imported soil, a declining ship-repairing industry as a result of cost of lumber and scarcity of labor—the local activities of the islanders are indeed restricted. In contrast, a whaling industry perpetuating its status under careful exploitation, a fishing realm capable of considerable development and permanence of the aspect of a strategic location relative to the South Atlantic, indicate the maintenance of an economy essentially that of the present.

CHAPTER VIII

CHILE

Chile, the ribbon-like strip of land stretching from the icy waters off Cape Horn at 56° S. for a distance of 2,630 miles to the tropical Tacna Valley at 18° S. latitude, holds an important place among South American republics. Though it ranks seventh in size and fifth in population, its wealth and commerce stamp it as the "C" of the A-B-C republics of the continent. In spite of isolation, remoteness and a large per cent of unproductive land, it is the leading country on the west coast. Often thought of as a small country, it embraces an area (289,800 square miles) equal to one-fourth of the vast expanse of Argentina (1,153,000 square miles); its area equals that of California, Oregon and half of Washington, a coastal region with which it is so frequently compared in physiognomy.

In the far south the fiords of Tierra del Fuego, the pounding waters against the headlands, the rains and clouds, and the mighty glaciers reaching the sea and giving birth to icebergs that drift away resemble those of Alaska. The Chilean sounds and fiords between the Cordillera and the Archipelago match the sounds and fiords between the coastal mountains and the Alaskan Archipelago. The cloudy, damp, wooded vales of Chiloé, Llanquihue, and Valdivia pair with those of Vancouver and the coast of British Columbia and Washington. Also the floor of the Chilean Valley dips beneath the sea at Puerto Montt as the Puget Sound Depression gives way to the sea at Seattle. Farther north Coastal Ranges, Central Valley and towering Andes have their counterpart in North America in the Coastal Ranges, the California Valley and the Sierra Nevada Mountains. In the Chilean Valley, sunny skies, irrigation ditches and broad vineyards recall the San Joaquin. Also the valley and piedmont oases of subtropical fruits and vegetables from Petorca to La Serena suggest the oases of Southern California. And then like Lower California and the Desert of Western Mexico, the Chilean Desert stretches almost without a break to the border of the country.

NATURAL HANDICAPS

This great variety of physical conditions, though giving an abundance of resources in different sections, burdens the country with a number of natural handicaps that reflect strikingly man's adjustment in the several parts of the country. More than 70 per cent of the surface is mountainous; only in the nitrate pampas, in the Central Valley, in the coastal valleys of Middle Chile, and along the Strait of Magellan do level stretches replace rugged terrain. Forty per cent of the

FIG. 53. A VINEYARD, CENTRAL VALLEY

Fertile piedmont soils, much sunshine, winter precipitation in the high Andes, irrigation water, and long hot summers all favor agriculture.

country is a parched desiccated land. More than one-third is too cloudy, rainy and cold for crops and human comfort. Also, in the desert scant vegetation repells, and in the south damp, dense forests stand like a wall in the face of human advance. Consequently, of all the vast domain of the republic, only 10 per cent fosters marked agricultural development, and that in Middle Chile, where fertile, alluvial, piedmont soils, winter rains and snows in the high Andes, long, hot, sunny summers, and varied vegetation all smile upon man (Fig. 53).

In addition, the position of Chile to the west of the great Andean

barrier and on the southwestern corner of South America has been a significant handicap. For a long period isolation contributed to the influences retarding progress. To reach these lands, the early traders were obliged to select one of several lengthy, arduous routes. The perils of sailing by way of the Strait of Magellan discouraged all-water communication, until the route around the Horn was discovered. At the north, the Isthmus of Panama and the Atrato Valley in Colombia provided ways made no less precarious by the prevalence of disease. The demands of commerce, however, caused frequent avail to be made of the more southern route, until the long-awaited breaching of the Isthmus. With the inauguration of services via the Panama Canal, Chile gained the multifarious advantages of the new route to world markets.

With no part of the country more than 250 miles from the ocean, the outlook has always been to the sea, a condition which has tended to hamper unity of interests. In spite of short distance to the sea from any point, Chile lacks adequate transportation facilities. While sixty or more ports have developed along the Chilean littoral, almost all of them are exposed to the ocean swell and at times to the "northers" which sweep the coast, so that there are no safe anchorages or harbors. In the absence of artificial break-waters ships anchor from a quarter of a mile to a mile and a half from the shore and transfer all freight and passengers by barges and launches, a slow and inefficient method (Fig. 54). Like those of the Coastal Desert of Peru, in general, the several coastal valleys and the mineral regions maintain individual shipping towns rather than send their produce to one great port. In the cases of Valparaiso and San Antonio, however, exceptions may be noted, for both serve the rich lands about Santiago. To the south, Constitución, Concepción, and Valdivia also have built up a more than ordinary importance as commercial centers; to the north—Coquimbo. Fishing on a commercial scale as yet is negligible. The rough seas and the rockbound coasts of the far south from the days of the first sailing vessel have taken their toll of shipping. Even today the south passage is not made without great caution and sometimes trembling and fear by the boldest sea captains.

Furthermore, Chile has only 5,650 miles of railway. Half this mileage is in the Longitudinal Railway, extending parallel to the coast, from Tacna in the north to Puerto Montt in the south, and

which consequently carries little freight, although it is connected with the coast by short spurs at more than thirty different places. No railway net exists, but short transverse lines connect mineral sections or agricultural districts with ocean ports. The only railway to Argentina—the Transandine—crosses the Andes through a tunnel at an elevation of more than 10,000 feet.

In addition, rugged terrain, desert wastes, deep, damp forests and large land holdings have restricted other land travel to jolting cart

FIG. 54. FLETEROS, ARICA, CHILE

At most of the West Coast ports of South America, passengers come down the steps and stand on the bottom one, waiting to jump as the rowboat or launch bumps into the foot of the ladder on the crest of a wave.

and pack animal. Good automobile roads in Chile are almost entirely lacking. Thus, physical conditions and transportation facilities have aided historical forces in the development of three distinct economic units or regions within one domain.

CHIEF ORIGINAL POPULATION GROUPS

Varied and diversified, the territory, now known as Chile, possessed, before white man came upon the scene, contrasted peoples and conse-

quent types of civilization. Some of them still persist but they have been changed greatly or have all but disappeared under the so-called civilizing influence of white man.

In the southern part of Tierra del Fuego are the Yaghans. Without weapons, they live in canoes or near the sea in brush shelters. The dog is the only domestic animal they possess. Largely without clothing, in a cold damp region, they subsist on gathered shellfish, crabs, fish, and occasionally birds' eggs. Diminished by a hostile environment, yet at the same time protected from the outside, they have been left alone primarily to continue their savage ways. Decreasing from 2,500 in number with the introduction of diseases half a century ago, not more than 100 remain.

The Ona Indians formerly roamed over the most desirable portions of Tierra del Fuego. Pushed southward by the white man, they occupy most of the southern half of the island, the rough and forested portion. People of the chase, they subsisted chiefly on the thousands of guanaco that fed on the moorland grasses. Aggression by the white man, robbing the Onas of their hunting ground, and introducing diseases has reduced the tribe from some 3,000 to not more than 500 souls.

The Alaculoof tribe, a fishing and hunting tribe, occupied the mountainous, damp, and densely wooded islands and headlands northwest of Tierra del Fuego. Lands unfavorable for pasturage or tillage faced them towards the sea for a living. They spent much of their time cruising, in large dug-outs, the tortuous channels and bays, camping on land in regular huts of boughs covered with skins or strips of bark. Decimated by rum and disease, through contact with crews of ships bartering for skins, only a few remain in the more inaccessible places.

The preceding three tribes, occupying the least desirable part of Chile, have all but disappeared. But farther north different conditions prevailed. The Chonos Indians and Chiloé Islanders, originally a hunting people and little disturbed by early wars, became highly mixed with immigrants. They are now valuable folk as excellent lumbermen and foresters.

In the Central Valley south of the Maule River dwelt the fierce Araucanians, a strong virile people, who withstood all onslaughts of Inca and Spanish soldiers. They were a forest people living by the hunting and fishing that forest and stream provided. But to the north of them were many sedentary independent tribes, who lived from the

fruits of the arid fields won by hard labor. They grew crops of maize and potatoes as well as beans and other vegetables. Attached to the land, unorganized, and in small units they offered comparatively little resistance to invaders.

THE MOULDING OF THE CHILEAN PEOPLE

During the latter part of the fifteenth century the Incas invaded what is now northern Chile and extended their conquests as far south as the Rio Maule (35° 30′ S.). Throughout the conquered lands irrigation facilities were improved and extended, crops and animals introduced and roads constructed. All the Indians were subjected to the civilizing influence of the Incas. At this time the first mixture of population took place.

In 1536 the Spaniards entered what is now the northern part of Middle Chile. Little influence was left from this first expedition of Almagro. But five years later Valdivia, with 200 Spaniards, many Indians from Peru, various monks, large numbers of domestic animals and a few wives of the soldiers led the second expedition into Middle Chile. He came to a halt on the banks of the Rio Mapocho after many Indian attacks on the way. There at the base of the hill of Santa Lucia the force encamped and established the headquarters of the Spanish *régime* in Chile after much hardship and suffering by Indian attacks (Fig. 55). Then began the organized attempts to free the valley of Indian troubles. First at the Rio Maule, Valdivia met a formidable enemy in the fighting Araucanians, the most fearless and persistent fighters the Spaniards encountered in the New World. Wave upon wave of Spanish soldiers and Indians was sent against them. In a century the Araucanian boundary had been pushed south only to the Rio Bio-Bio; there it remained throughout the colonial period. Where as in most other parts of South America the conquest was over in an amazingly short period, in Chile the Araucanians would not be subdued. For three centuries a succession of Spanish soldiers streamed towards Chile. The possession of Chile cost Spain more men, blood and treasure than all the rest of her settlements in America.[1]

But this great conflict gave this region a constant intermingling of races and a pouring in of new Spanish blood all the time. In the early

[1] Molina, G. I. "Saggio sulla storia naturale del Chili," two volumes, Bologna, 1782, 1787; reference in Volume II, p. 264.

years of the Colonial Period Chile was a man's colony; few white women came. The soldier took captive women to attend him. Four to one was the ratio of the sexes in the garrisons.[2] For three centuries innumerable native women became the booty of the fighting Spaniards and bore them many children. This blending of strains resulted in the Chilean race, the highest type mestizo anywhere on the southern continent.

South of the Araucanian stronghold Spanish control was more

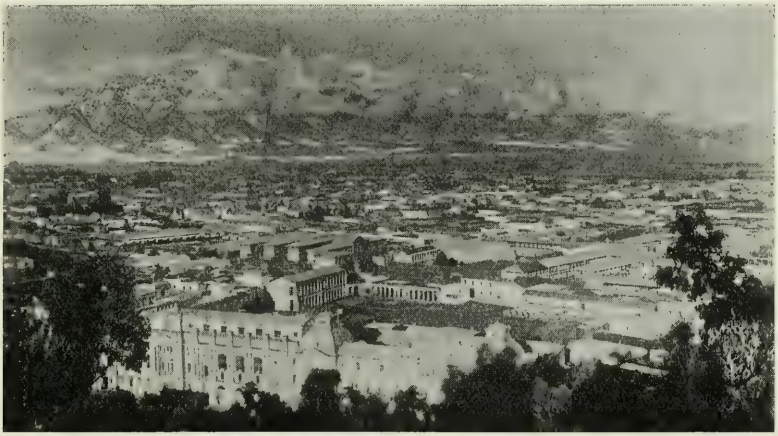

FIG. 55. SANTIAGO, CHILE

Santiago sets like a gem in the northern end of the Chilean Valley, with the towering Cordillera to the east shrouded in a veil of thin clouds and crowned with caps of snow.

easily extended, especially in the regions of Valdivia and Chiloé. Here Spanish settlement, despite many discouraging trials, was permanent though scattered in little patches in the deep, forest solitudes. But the Frontera, the Araucanian forests, still remained intact, with the southern boundary undefined; Spanish attempts to penetrate the Frontera were repulsed repeatedly. At the date of Chilean independence the rights of the Araucanians to the territory south of the Bio-Bio were recognized by treaty.

[2] "In 1550 the married men in Valdivia had up to thirty concubines apiece. Aguirre, one of the conquistadores, left at his death fifty legitimate sons, to say nothing of daughters. De Escobar had eighty-seven living descendants and he by no means held the record for his time." Nicolas Palacios, "Raza Chilena," 2 volumes, Santiago, 1918; reference in Volume I, pp. 45–56.

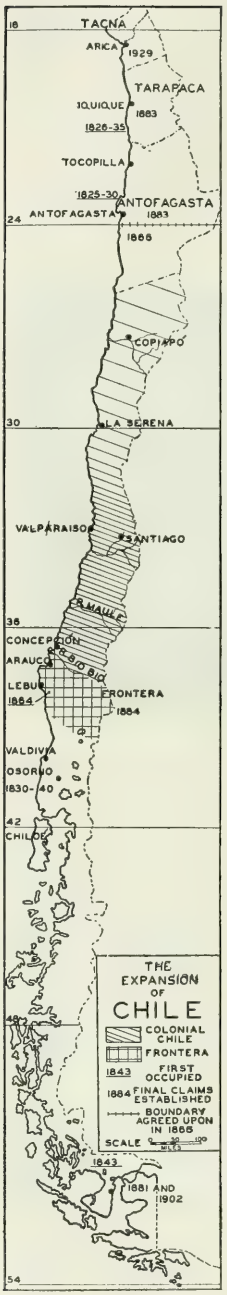

FIG. 56.—Chile expanded from a nucleus in the Central Valley in a relatively short time to the desert wastes in the north and the bold headlands of the far south.

THE REPUBLIC

At the time of independence Chile embraced the land south of 26° S. just north of Copiapó, to the Rio Bio-Bio, the border of the Frontera (Fig. 56). A few settlements existed from 39° to 42° but they were of little consequence. Thus hemmed in on the east by the Andes, on the north by the vast desert and on the south by the Indian-infested forest—the Frontera, a zone about 140 miles wide—Chile, in a relatively short time, developed solidarity and strength that paved the way for later expansion. As early as the late 40's active colonization began in the region south of the Frontera, then known as Valdivia. In the next decade some 3,000 Germans were settled at a number of places as well as many Creoles from Central Chile, since that part of the country was already crowded owing to the large land-holding system that prevailed.

In 1846 the Indians in the Frontera, reserved by treaty, staged an uprising, which gave the Chileans an excuse for disregarding the treaty. Troops moved in and promptly opened the hitherto inaccessible Frontera to settlement; colonization measures were passed; lands, sold at small price on long terms, were taken up by large holders and small families. Then from 1883 to 1901 some 36,000 European immigrants came, chiefly Spaniards (11,000), French (8,500), and Swiss (4,000). Thus by steps Chilean control and consolidation advanced from the Bio-Bio to Chiloé and beyond.[3]

[3] The Longitudinal Railway reached Puerto Montt in 1912.

In the far south Tierra del Fuego and the Strait of Magellan were anybody's land up to 1843. In that year, Chile took possession of the Strait because of its value as the Chilean highway. A fort built at Port Famine was soon moved to Punta Arenas. But not until after 1890, some ten years after Chile's claims to the area in Tierra del Fuego and near Punta Arenas were limited and recognized (July 23, 1881), did the far south begin to get the large increments of population that give the country its distinct stamp and developed it as valuable Chilean territory.

As early expansion was taking place in the south, events that were to have a profound influence on the nation were transpiring in the north. Shortly after Chilean independence the nitrate industry began by Chileans in Antofagasta, claimed by Bolivia, and in Tarapaca, Peruvian territory. From 1840 to 1860 the industry developed rapidly; several companies were formed, most of the people engaged in the enterprises being Chileans. Naturally disagreements arose between these countries. In 1866 Chile and Bolivia agreed on the parallel of 24° S. latitude as their boundary; each republic was to turn over to the other half the customs duties received within one degree of the boundary. Antofagasta, just north of the boundary, became one of the chief shipping points for nitrates and a main outlet from Bolivia; but Bolivia did not pay to Chile one-half the customs received; no accounts were kept so Chile could not claim any exact amount of money. Then in 1874 Chile gave up her claims to these sums on condition that Bolivia would not, for twenty-five years, exact any duty beyond those then in force for the territory between 23° and 24° S. Chilean companies prospered; but only four years later Bolivia imposed a minimum tax of ten cents per hundred pounds of nitrates exported. The Chilean companies refused to pay the tax; Bolivian soldiers seized the company's property, offices and stores.

Chile, obliged to protect her people and their property, seized Antofagasta, and by February 1879 had occupied Tocopilla and Cobija. Bolivia had no choice, except to fight; Peru joined the affray with Bolivia, complying with their secret pact of February 6, 1873, that if one became involved with Chile over the nitrate deposits the other would assist. By the end of March the Bolivian forces were

entirely driven out of the nitrate region. Then followed the five-year struggle with Peru on land and sea and the occupation of Peru.

At the treaties of peace in December 1883, Chile gained Antofagasta and Tarapacá and Tacna[4] with their nitrate fields, guano deposits and mines. The War of the Pacific established Chile as the leading nation on the Pacific coast, knit all classes of Chileans [5] in a strong consciousness of nationality, reduced the number of internal political disturbances, and gave the country absolute control of the great mineral wealth, the foundation of Modern Chile.

FIG. 57. THE FERTILE CENTRAL VALLEY

Modern and primitive transportation meet in the Central Valley; wheat being transferred from ox-cart to railway.

MODERN CHILE

Out of the consolidation, the political expansion and the wealth obtained by that expansion, from the early days of the republic to the close of the War of the Pacific, the Chile of today has grown. The trade of Chile in 1880 was about $25,000,000; today it is nearly $400,000,000. From a few scattered lines then, the railway fabric of the present has evolved; the population of the country has almost doubled. With nearly four million people Chile has become the third or fourth nation among the council of nations of the twenty-one Latin-American republics. In the north nitrate, copper and other mineral developments have emphasized the contrast between the Chilean

[4] After ten years the people of Tacna were to be allowed to choose their country by plebiscite.—See Chapter XII for the final settlement of the Tacna-Arica dispute.

[5] It combined rich and poor, landowners and *roto*, immigrant and native, and official and Indian. The Araucanian Indians sent a contingent to the War; following the War the chiefs withdrew their exclusive right to the Frontera and opened the way for the great colonization that followed.

Desert and the lands to the south. There smiling valley farms, water power, coal, forests and a varied dense population diversify the activities of the throbbing heart of the country—Middle Chile (Fig. 57). Beyond, the dismal, damp, forested headlands, with scattered degenerating Indian folk and the great sheep ranches with hardy rugged herders along the Strait of Magellan, connote South Chile.

CHAPTER IX

SOUTH CHILE

Among the regions of the world notable for paucity of resources favoring human settlement, the major portion of South Chile holds a distinctive place. A long list of handicaps, embracing elements of all natural conditions—rugged relief, too copious rains and snows, dense forests, infertile soils, scant animal life, ragged coast line, and stormy seas—dominate the area. Only in the southeast, where the Andes sink into the sea and are succeeded on the east by the grassy plains of Patagonia, has economic activity proved practicable. The great sheep lands have little in common with the myriad islets of the archipelago or with the intricately articulated mainland. In contrast, much of the territory about the Strait of Magellan affords relatively gentle relief, moderate rainfall, steppe vegetation, and exceptionally fertile soils in many areas; and here, too, if native animal life is unimportant, in its stead the inhabitant lives upon the produce of millions of exotic animals—sheep. Nevertheless, distinguishing the area, South Chile exhibits uniformity in one respect. Exclusively the outlook is toward the sea. The ocean affords the sole feasible means of communication between Puerto Montt in Middle Chile, and Magallanes, formerly called Punta Arenas, the city center for almost all of the southern realm. So difficult of penetration and so stinted in readily developed resources, the forested mainlands of South Chile comprise some of the least explored areas of the globe and witness little human activity. Only the sporadic visits of permanently impoverished fisher-folk disturb the damp solitudes of districts not directly open to the sea. Despite deeply incised fiords leading far into the interior, transverse movement is to all intents non-existent. The tumbling waters of the numerous streams deter further any attempts aimed at sections even slightly remote from the sea.

As a consequence of its manifold shortcomings, South Chile has a strikingly low density of population. Over most of its extent, the

land supports much less than one person per square mile. Vast districts have not felt the tread of man. A stretch of some 600 miles of islands and rough headlands between Chiloé and the Strait of Magellan is all but without human habitation. In the deep fiords of western Tierra del Fuego, the Fuegian tribes, the southernmost folk in the world, a people still in the hunting and fishing stage, struggle to eke out a bare subsistence from damp forest and sea. Magallanes, entrepôt for broad areas in Argentina as well as South Chile, provides the one important concentration of population. Its 22,000 inhabitants rely almost entirely upon the tributary sheep ranges, although, in addition, the town possesses significance because of its strategic location on the Strait. The storminess of the Magellan waters delayed realization of the latter advantage until steam vessels could negotiate the passage. Now a free port, Magallanes exhibits a conspicuous activity in harbor and in city, and expresses the industry of the large colonies of herders from Scotland, Ireland, Falkland Islands, and Middle Chile on the broad stretches of grasslands.

PHYSICAL CHARACTER

The largest and least favorable portion of South Chile embraces a stretch of almost 1,000 miles. It consists principally of the heavily forested slopes of the Andes, reaching an elevation of more than 10,000 feet, and the associated fringe of islands separated from the mainland by a maze of tortuous channels. In several ways, this zone resembles the coastal section of British Columbia and southern Alaska. Few strips of lowland exist. From the glaciers and snowfields of the Cordillera numerous sparkling, rushing streams plunge from deep valleys into the cold waters of the fiords, streams of no avail for navigation but promising a future storehouse of abundant hydro-electric energy. The cold waters of the South Pacific, lapped and churned by the strong and constant western winds, pound against the bold headlands of the islands and peninsulas, which rise abruptly from the sea to precipitous heights near the water's edge (Fig. 58).

Adjoining the western section, the less heavily forested, though more remote, Patagonian depression adds another district of scant peopling to the lands of South Chile. Here as well, ruggedness dominates much of the landscape, but lowlands compose a much larger part of the total than in the coastal area. With the institution of

better transportation facilities, like most of South Chile, the scenic beauty of deeply eroded high mountains, covered in the main with evergreen forests interrupted by numerous glaciers, connotes a possible tourist trade of some value to the region.

The only area dominantly plain and unforested produces the wealth of South Chile. Over the small expanse of steppe-land, pastoral industries have eagerly grasped the opportunities for grazing enormous herds of sheep. Northwestern Tierra del Fuego possesses a large part of the aggregate grazing area.

To the handicaps due to topography, climate contributes features

FIG. 58. BERTRAND ISLAND, SOUTH CHILE

A sheep station of the cool, rainy, far south. (*Photo by Rollo H. Beck; courtesy of the American Museum of Natural History.*)

even more pronouncedly unfavorable, although in the east, the adversity of climatic conditions decreases. Precipitation annually exceeds 80 inches over much of the area; dreary, cloudy skies hide the sun much of the time; cool, penetrating winds enervate man and beast; continuously low, though not extremely so, temperatures prevail—Chilean government officials who reside in even the more liveable south receive far higher salaries and longer vacations than those in many other regions. Under the influence of the cyclonic storms of the prevailing westerlies, the forest districts, with little divergence from season to season, are rainy, damp, and dismal, and discouraging to settlement. Even in the driest periods fires are lighted with the greatest of difficulty—so water-soaked are terrain and vegetation.

Huge quantities of snow augment the burdens afflicting life here; on Tierra del Fuego, the snow-line exists at less than 2,500 feet, in the north about Lake Llanquihue, at 5,000 feet. The eastern zones differ markedly from the west. Whereas on the west Bahía Félix receives an annual precipitation of 208 inches, Punta Dungeness on the east records 9 inches, a situation borne out also in the contrast between the northern islands and coast and the eastern trough.

FIG. 59. THE CORDILLERA, NEAR MOUNT TRONADOR

Much of the land of South Chile consists of rugged forest slopes and snow-crowned summits. (*Courtesy of J. Wilderhold.*)

Though the Pacific forest of South Chile is among the densest of the world, its utilization on a large scale is impracticable at the present day, chiefly because of a lack of transport facilities and the difficulty of providing such means (Fig. 59). In the south on the Strait of Magellan, however, where proximity to the sea permits exploitation, a few saw mills operate and export significant amounts of lumber, principally to Argentina. Possibilities for a pulp-wood industry also may materialize. Since the region has a broad latitudinal extent and much variety in altitude, the forests possess many kinds of stands. Various beeches, however, preponderate. *Coihué* (*Nothofagus dombeyi*) and *roble* (*N. oblequa*) constitute nearly half the growth.

Associated with the beeches are the *ciprés* or *cedro* (*Libocedrus chilensis*), fairly common in the mountains and in some lowland localities, and *alerce* (*Fitzroya patagonica*), which occurs principally in low, swampy or bog lands. Southward the trees gradually become smaller and more stunted, so that at the Strait much of the forest scarcely is more than a shrubby area growing below 2,000 feet. Extensive grasslands occur principally on the southern heights. On the eastern slopes, the forest, here notably less dense, shelters a thick undergrowth of succulent grasses and shrubs.

In the eastern depression and the territories about the Strait, the conditions of light precipitation and powerful winds have favored the development of an excellent grassland. Tussock grass (*Poa flabellata*), various herbaceous flowering plants, ferns, mosses, and lichens, and numerous prostrate shrubs and bushy growths have furnished ample forage for the grazing of sheep.

THE SHEEP INDUSTRY

Though the Strait of Magellan had been occupied since 1843 by the Chileans, the great value of the cold, temperate grasslands for sheep was not realized until after 1877.

Following a primary attempt to raise cattle in cleared forest lands south of Magallanes, the sheep industry began a rapid growth. In 1885 the region grazed some 40,000 head; by 1891 they had increased to 500,000. Today the Chilean plains bordering the eastern stretch of the Strait of Magellan produce more than three-quarters of the wool exports of Chile (Fig. 60). Here some 3,000,000 animals that grow heavy fleeces of high quality yield 20,000,000 pounds of wool annually. In addition, large shipments of Argentine wool, chiefly from the San Julian and Gallagos districts, are transshipped at Magallanes. In some years the Argentine product swelled the export volume handled by the Chilean port by more than 50 per cent. Besides the leading product, the great flocks send an annual quota of more than 1,000,000 head to the half-dozen freezing plants tributary to Magallanes.

Characteristics similar to, but considerably less pronounced than, those of the forest area foster the industry. To meet the requirement for a commodity of high value and little bulk for production in an isolated region, the physical conditions have proved exceptionally

FIG. 60

The temperate plains and highlands are the great sheep regions of South America.

fit. The evenly distributed rains provide good pasturage throughout the year and ample water supplies; a light snowfall permits winter grazing; the uniformly low temperatures favor the growth of a wool of fine texture and low specific gravity; the strong winds quickly dry damp areas after rains; and the moist vegetation-covered surface keeps fleeces clean of dust and burs (Fig. 61). In return, however, severely cold snow storms may kill thousands of sheep annually and scab is a serious menace.

Most of the range land already has been parcelled into vast *estancias*, in cases embracing more than 2,000,000 acres. British owners control virtually all of the product, while the herders are predominantly Scotsmen, Welsh, Germans, half-breeds, and Falklanders. The sheep consist generally of a cross between the merino, for wool, and the Romney Marsh, a mutton and wool breed adapted to moist lands. Shepherd and dog tend the individual flocks in their migrations over the vast ranges. Periodic visits are made to the ranch headquarters for dipping and shearing. Wool moves to the shipping points by convoys of wagons, while after the shearing, surplus sheep travel in great numbers to the packing plants.

Fig. 61. The Wealth of South Chile

The lake-dotted country of South Chile is a wonderful sheep region, but of little utility otherwise.

As a whole, South Chile can expect little development for a long time. Other parts of the country justify expenditures far more than

these remote lands. A marked increase in the sheep industry is unlikely for all of the better pasture lands have been leased or are owned for grazing of the animals. Some ranges already have reached their maximum carrying capacity and are declining. Moreover, as with the unpopulated forests, the far south has little contact with the centers of Chile. While the remote isolated mountain recesses of South Chile may contain valuable mineral deposits their existence is unknown; should they be discovered, physical handicaps to utilization are well-nigh prohibitive. The forests offer opportunities for a gradual exploitation of resources in lumber and pulp-wood, while the numerous streams could provide power for industrial activity. More attractive lands, however, will keep people away from this region for scores of years. Most of South Chile will continue indefinitely as a solitude of lush forest and a land imperfectly known.

CHAPTER X

MIDDLE CHILE

Were complete self-dependence a requisite for the modern nation, Middle Chile would hold first rank among the geographic provinces of South America. It extends from the moist green forests of Chiloé to the barren lands of the Chilean Coastal Desert. It affords within easy access of one another elements favoring the development of an advanced people—healthful climate, relative abundance of fertile and arable land, comparative ease of internal communication, sufficiency of forest resources and diversity of fuel and mineral wealth. Add to these the favorable mixture of population, and human progress becomes even more assured.

Yet Middle Chile can never attain a significance comparable to that of other countries of South America. The restricted size of its useful portions greatly deters marked expansion. All Middle Chile, including the extensive tracts in generally unutilizable mountain terrain, embraces a bare 100,000 square miles. The great wheat crescent of Argentina can contain several regions the size of potentially useful Middle Chile. Also, for a long period, isolation, though retarding progress, gave compactness not characteristic of other sections of South America.

Despite formidable shackles of small area, prolonged isolation, large land holdings, and efforts spent in expansion, Middle Chile has achieved recognition as the seat of one of the three principal powers of South America. The recurrence of many factors which have enabled the rise of cradles of civilization in other parts of the world has nurtured the growth of this nucleus of Chile.

Although the southern humid portions of Middle Chile had supported a native population long before the arrival of the European, the unforested north lay chiefly unpeopled. Under the protective influence of the forests, the Araucanian Indians had developed an advanced culture. The Incas never conquered them. Spanish subjugation proceeded slowly. Time and again the Araucanians destroyed

the invading settlements. In the seventeenth century they recovered their domain in its entirety, but gradually missionary, merchant, and farmer drew the forest lands into the sphere of Santiago. European civilization swept on and about the Araucanians, but their complete assimilation remains unaffected. More than 100,000 inhabit the lands between the Gulf of Arauco and Osorno, either in sporadic groups or in the principal center about the Tolten River basin. Now a totally agricultural people, progressive in spirit, they have contributed not a little to the intrinsically sound fusion of Spaniard and Araucanian characteristic of the Chilean people of today.

In contrast to the lands belonging to the Araucanian, the northern realm of Middle Chile soon became exclusively Spanish. Here natural conditions, especially conducive to the rise of Spanish culture, resembled in many ways the region surrounding Madrid. With neither Indian nor forest to overcome, the Europeans established an irrigated agriculture to sustain the new settlements.

A third group of population grew up on the island of Chiloé and later at the southern end of the valley. On the island the Spaniards found a people with a friendly disposition, a people whom the Jesuits easily converted. A slow mixture ensued, the settlers deriving a living primarily from forest industries. In the middle of the nineteenth century, the near-by mainland secured a start towards importance, for 3,000 German immigrants settled about Lake Llanquihue and in near-by areas. In addition to the agriculture developed on burned forest clearings, the new population pursued exploitation of the forest for lumber. In a few years, Puerto Montt became the leading lumber center of Chile.

Thus early Middle Chile comprised the agricultural north, the unconquered forest-dwellers of the intermediate lands, and the mixed peoples of Chiloé and associated districts. Communications between the two European portions was perforce by sea, but bit by bit extensions were made on land, more rapidly from the north. The days of the struggle for independence aided the cause of closer relations, but not until the completion of the southern sections of the Longitudinal Railway did Middle Chile secure an effective unifying bond.

The distribution of population in present-day Middle Chile displays the effects of this original partitioning, though as a whole the

region supports a peopling of exceptional density for South America and in it live almost nine-tenths of the 3,820,000 people of Chile. With major agglomerations about Santiago, Valparaiso, and Concepción, the latter arising from rapid progress in various industries based upon near-by coal, much of the region—chiefly that in the Central Valley—has between 30 to 60 persons to the square mile (Fig. 62). The ruggedness of the coastal and Andean portions in most of the north-south extent, the aridity of the section north of the Central Valley, and the heavy precipitation of the south are reflected in less density.

While the influx of Spaniards, French, Italians, Germans, and less numerous elements tends to build a middle class of some power, the economic structure of Middle Chile suffers from the broad gap between the oppressed *roto*, who composes 60 per cent of the total population, and the influential landed upper class. So pronounced is the desire to maintain an agriculture based on large land holdings,[1] that the laborer holds a position in many respects akin to that accorded the lower classes in the feudal system. On the great *estancias*, which may embrace entire coastal valleys, the plodding tiller of the soil, the *inquilino*, almost as permanent a feature as the property, supplies cheap labor.[2] With fertile soil, sunshine and irrigation the land yields abundantly. Thus agricultural expansion is hampered; no incentive encourages a widespread use of modern implements, and the profits gained by the owner of the vast properties argues effectually against division of property. Nevertheless, two districts manifest a modification of conditions. About Santiago the high value of rural land has forced subdivision. In the south the settlements of

[1] One per cent of the population owns nearly two-thirds of the good agricultural land, and opposes taxes and improvements that will place any burden on these large estates.

[2] "The *inquilino*, or *roto*, has a pretense at wage, the use of an acre or two of land, a wretched hut of unbaked bricks with roof of thatch, the privilege of using some animals from the farm, and fairly feudal obligations to serve all the needs of his master's house, he and his family too. In return the *inquilino* does what work the *patrón* asks of him. He toils hard and lives miserably, but life is assured him and his invariably large family. Under the Creole system he may always count on a good deal of advice, on care in sickness, when medicine and personal attention will be provided, and on help and protection in special adversity. The *patrón* does not mind how wretched the state in which his *inquilino* lives but would be ashamed to let him starve.

"Sons of the *inquilinos* may drift to the city, where good fortune may find them some work; but there are few factories, and there is little need for hands. Many go to the Argentine, both to the southern region and near Mendoza. The lot of the landless Chilean is very hard. He cannot find work in a country that has always encouraged and aided immigration."—Jefferson, Mark. "Recent Colonization in Chile," *Research Series No. 6*, American Geographical Society, New York, 1921. Reference on page 4.

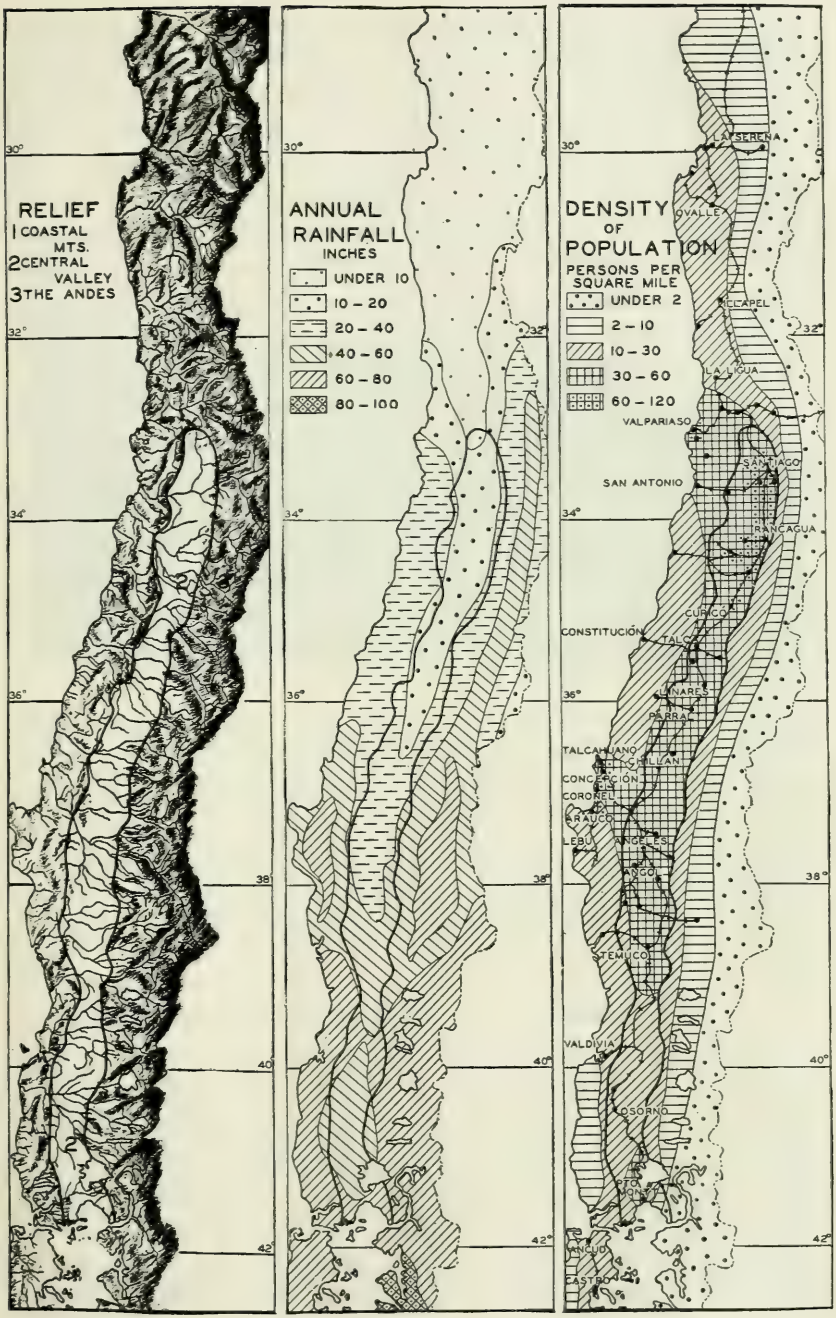

FIG. 62. MIDDLE CHILE

progressive German and Dutch farmers engaged in general farming and dairying provide a second indication of the trend towards smaller parcelling of the land. The growth of a middle class devoted to agriculture will contribute materially to the future welfare of Chile.

As in all Chile, the outlook to the sea as a main thoroughfare has tended to hamper unity of interests within the region. Economically the short distance to the ocean from any point of the interior and the rather adequate coastwise steamer services detract from the possible utility of the Longitudinal Railway other than principally as a strategic line of communication. Numerous short spurs leading to the ports have a significance far greater than the main line.

As for the Andes, the great mass enhanced markedly the outlook towards the sea. The one railway to Argentina—the Transandine—crosses the giant range through a tunnel bored at an elevation of more than 10,000 feet. Plans for lines at easier southern points are far from realization. Here the abundance of low passes early gave rise to a flourishing trade between Argentine Neuquén and South Middle Chile. Even the aboriginal Indians took advantage of the commercial possibilities by rustling cattle from the Pampa and driving them to the fairs of the Central Valley.

Other than rail, movement depends largely on oxen over poor roads, although about Valparaiso and Santiago a growing network of automobile highways promises an alteration of conditions. As indicated by the courses of streams athwart the topographic provinces, river transportation adds little to the means at the disposal of the country, although several streams permit navigation for small boats for distances as great as 50 miles. Irrigation requirements lessen the navigability of several of the rivers.

THE PHYSICAL SETTING OF MIDDLE CHILE

Owing to its extent of 900 miles in latitudes, 30° S. to 43° S., and the variety of elevation from sea to Andean Crest, Middle Chile displays an extraordinary diversity of physical conditions. Whereas coastal mountains, central valley, and the Andes provide three distinct topographic features, each unit is further subdivided by the transverse arrangement of climatic and vegetational conditions. In general, human response mirrors these features. Thus, in the north there has evolved an area of irrigated crops—the Mediterranean

Crops Region, the most productive portions of Chile, where mineral exploitation is also of importance. In contrast, the more moist south has developed into a territory devoted to three industries closely adjusted to local factors—grazing, farming, and lumbering. Both to north and south, Middle Chile is limited largely by climate and vegetation. In the hot region north of La Serena, scant rains prohibit the growth of natural forage which farther south feeds the animals of Middle Chile. South of Puerto Montt and the cleared lands of

Fig. 63. Chilean Valley, near Chillán

Meandering streams and rolling country typify large areas in the southern portion of the Central Valley; excellent farm and pasture land. (*Courtesy of D. S. Bullock.*)

Chiloé, the cold rainy forest and rugged relief prevent much use of the land.

Relief and Soils.—On the whole, the relief features of Middle Chile fall into three major systems. (1) The coastal strip consists of small, fertile, transverse valleys separated by comparatively rugged segments of the coastal ranges. The rough lands rise to a maximum of approximately 7,000 feet, although the average is less than 1,000 feet. (2) Extending northward only to the vicinity of Santiago, the Central Valley comprises the rich piedmont alluvial plains at the foot of Coast Range and of Andes (Fig. 63). Though generally level to rolling in parts, low ranges of hills and river valleys afford relatively sharp interruptions. In the Central Valley, as well as in the Coastal zone, soil conditions have little uniformity. In general, the river valleys afford a dark rich clay loam, while the adjacent lands are chiefly clayey. Though sands and gravels are abundant also, on the whole

wherever provided with sufficient moisture the soil is highly productive. In the south, however, under the leaching action of the heavy rains, soils have lost considerable fertility. (3) The Andes constitute the most conspicuous, though least utilized, of the divisions of Middle Chile. Their greatest value lies in enormous, and as yet scarcely prospected mineral wealth and in the waters which their heights provide for numerous streams utilized in irrigating the lowlands and providing hydro-electrical energy. Rising to more than 20,000 feet through much of their extent, they remain an almost insuperable barrier.

While the tectonic phenomena which have resulted in the formation of the Central Valley have favored the economic evolution of this rich land, at the same time the physical instability of certain portions is a source of constant danger. Earthquakes have caused enormous damage from time to time and are a problem of serious consequence. In addition to a long series of earlier disasters, in 1906, the year of the San Francisco shock, a terrific quake shattered a large part of Valparaiso. In 1928, the zone about Talca suffered an exceptionally violent disturbance. Minor quakes are a common and generally disregarded occurrence. The earthquake is one of the few physical elements of Middle Chile decidedly unfavorable to human settlement.

Climates.—Since at various seasons of the year parts of Middle Chile come under the influence of the zone of southeasterly trade-winds, of the subtropical high pressure belt, or of the stormy westerlies, its climates show broad diversity. Some two-thirds of the region has a distinctly Mediterranean climate and in consequence a corresponding vegetation and agriculture. In contrast, the southern lands receive abundant rains throughout the year; hence wheat, oats, and potatoes, dairying, and forest enterprises, rather than wheat, corn, alfalfa, and vineyards.

Like other regions which enjoy the features of a Mediterranean climate, the northern lands of Middle Chile receive the bulk of their rains in winter. Santiago registers 60 per cent of its annual precipitation of 14 inches in June, July, and August, while in summer intense drought prevails. In December, January, and February, only three-tenths of an inch of rain falls. In all Mediterranean Chile the total annual rainfall is comparatively light. From less than 10 inches at La Serena, it rises to more than 50 inches south of Concepción, the Central Valley in general receiving less than the Coastal Districts,

and the coast less than the higher Andes. In a land of pleasant climatic conditions, the opening of the rainy season brings a realm of brightly colored flowers. Valparaiso—Vale of Paradise—owes its name to the beauty of the neighboring lands. Except for morning fogs in the Central Valley occasioned by the mountain breeze, blue skies and brilliant sun prevail for much of the year. In the agricultural zones uniformly high temperatures extend through a growing season of twelve months in the north, and more than six in the south. Summer drought indicates the necessity for irrigation, and the relative abundance of winter snows in the mountains provides a fortunate store of water for summer irrigation.

Though south of Concepción, summer is still the drier season, the character of the climate changes. The summer receives less rain than other seasons, but by no means is it one of notable drought. The passage of cyclonic storms to the south of Cape Horn brings moist northerly winds to these lands, so that throughout the year no dearth of rain exists. Winter again brings most of the precipitation, sections of the south receiving more in this quarter than most of Mediterranean Chile in the entire year. With more than 80 inches of precipitation per year and a comparatively uniform seasonal distribution, the climate of south Middle Chile differs widely from that of the north. Here the problem is not so much one of securing water for irrigation but of draining swamps or of receiving sufficient sunshine and warmth to cure hay. The low summer temperatures produced by latitude and rains distinctly restrict the cultivation of various grains, particularly corn, a crop extending several degrees farther toward the poles in less humid lands.

Vegetation.—Reflecting the régime of rains, vegetation in Middle Chile embraces two principal divisions in addition to the barren upper reaches of the Andes. The Mediterranean type of plant cover in many respects, resembles the *maquis* of Europe and the *chaparral* of North America (Fig. 64). In its more humid portions, north Middle Chile supports considerable areas of forest. The coastal forest extends in broken patches to 35° S., that of the Andes to 34° S., at elevations between 3,000 and 7,500 feet. A deciduous beech (*roble Nothofagus obliqua*), closely resembling the oak, is the most characteristic tree. Farther north, shrubs of hard small leaves, various acacias, and stands of cacti grow on the coastal ranges and on the slopes of the

Andes. The floor of the Central Valley, which in much of the South has been cleared of original tree growth, here supports various grasses and thorny evergreen shrubs.

As precipitation increases southward, the forests descend towards

Fig. 64. Coastal Range, Near Talca

Low bush vegetation on the hills; exotic eucalyptus and willows; the only use of the low hills in this region consists of grazing.

the valley, and south of 38° S. occupy most of the land not cleared for farms. Breaks in the forest cover occur in the rather extensive swampy tracts of the far south or on excessively porous limestone areas. On the lower slopes and in the Valley, the forest consists of a dense stand of Chilean beeches and cedars and a luxuriant under-story of brush. The principal arborescent species, all of economic value, are the *roble, coihué* (*Nothofagus dombeyi*), *raulí* (*N. procera*), *laurel,*

(*Laurelia aromatica*), *lingue* (*Persea lingue*), *canelo* (*Drimys winteri*), *alerce* (*Fitzroya patagonica*) and *ciprés* or *cedro* (*Libocedrus chilensis*). On higher slopes this forest gives way to the Chilean pine association, composed largely of *Araucaria imbricata*. The wealth of the southern forests has given rise to a growing lumber industry about the Gulf of Reloncavi. More than half of the original growth in the district already has been cut.

AGRICULTURE IN MIDDLE CHILE

In a country having so much of its territory in the hot northern desert and in the likewise desert wet South, the variety of its wealth emphasizes the great productivity of Middle Chile. Its agricultural resources in particular sustain the fabric of the Chilean republic, but as a source of export products, the desert far outranks Middle Chile. Production for domestic consumption is the primary end of agriculture in the Central Valley and in the Coastal districts; a large number of crops are produced, the major part of which grows in the fertile fields of the irrigated north.

The Mediterranean Crops Region.—Though small in areal extent, the heart of Chilean agriculture has a significance exceeding that of the remainder of the country. It has some two-thirds of the cultivated land of all Chile, 95 per cent of the acreage in vineyards, barley, and corn, plus 85 per cent of the land sown to alfalfa. Moreover, it produces 98 per cent of Chilean wine, 66 per cent of the wheat, and despite its semi-arid climate grazes much of the livestock. Yet, only 12 per cent of the land is in crops, although a possible 75 per cent may be classed as pasture consisting largely of brush hill land of low carrying capacity.

The Central Valley Sub-region.—The essential source of foodstuffs for the Chilean people, the Central Valley portion of Mediterranean Chile constitutes the most densely settled and richest agricultural region on the entire west coast of South America. Extending for 400 miles in the northern two-thirds of the valley, the territory has acquired distinction as the "promised land of Chile," because of its broad, piedmont, alluvial plains which slope gently from the Andes and its rich soils so productive under the benign influence of long growing season, bright sunshine, and irrigation waters.

In the rain shadow of the Coastal Ranges, this agricultural sub-

region must resort to irrigation to supplement the rainfall occurring chiefly in winter, so that at present it contains 90 per cent of the irrigated land of Chile. Conditions are almost ideal for irrigation: sloping alluvial plains, on which it is easy to direct water from the sediment-laden streams rising in the high mountains where heavy winter snows melt slowly during the long, bright, dry summer; ample supply of water; deep alluvial deposits capable of holding waters like huge sponges, yet fairly well drained, and capped by fertile soils. Were it not for the vital waters of the Aconcagua, Maipo, Maule, Itata, Laja, Bio-Bio, and many minor streams, the fields of much of Central Chile would be barren of cultivated crops. Farmers secure a secondary store of irrigation waters by constructing tanks to catch and hold the winter rains. Recent developments point to a considerable expansion of facilities. Formerly, associations of proprietors maintained all irrigation systems. With the intervention of the government the scale of activity has increased, with the result that near Santiago some 62,000 acres have obtained water, while to the south a canal tapping the Maule River irrigated 115,000 acres and a newly installed system derived from the Laja River waters 110,000 acres.

Since the Central Valley has larger areas of more readily irrigated territory the intensiveness of use of land exceeds that of the Coastal Sub-region. Representative rural departments of the Central Valley—Maipo, Loncomilla, and Bulnes—have approximately nine-tenths of their extent in landholdings, of which more than one-quarter is irrigated. Parallel representative rural departments of the Coastal Sub-region—Casablanca, Chanco, and Concepción—have less than three-quarters of the area in landholdings, with irrigation employed on only 1.5 per cent of the total. Of the Central Valley landholdings, crops occupy 16 per cent, pasture 55 per cent, and woodland 20 per cent; of those characterizing the coast, the figures are 11, 58, and 28 per cent respectively. The departments of the Central Valley support more than twice as many animals as those of the Coastal Sub-region; in the former population density figures 75 per square mile and in the latter 37 (excepting the city of Concepción all areas represent rural districts). The contrasts in these departments hold true, as a whole, for the sub-regions they represent.

Owing to the relatively large population of Chile dependent upon the cultivated area, food and feed crops hold almost all the land.

Nearly three-fourths of the tilled area grows wheat, corn, barley, oats, alfalfa, clover, vetch, beans, and potatoes, while vineyards occupy 12 per cent of the total (Fig. 65).

Wheat, the principal crop throughout the valley, in addition to supplying a home demand consistently furnishes a surplus for export. Despite poor methods of tillage and harvest, its high yields, 25 to 30 bushels per acre, make it a valuable crop; it occupies almost half of the

FIG. 65. MELON FARM NEAR SANTIAGO
The fertile level floor of the Central Valley produces a variety of crops.

cultivated area. Favoring conditions embrace: a cool, moist, formative period in autumn and early spring; moist warm spring; a dry, hot, sunny ripening and harvesting season; fertile soil; and freedom from diseases and pests. In favored districts, the crop thrives without irrigation. Sowing, generally by broadcast methods, comes in autumn (May and June) on spring-plowed land. Producers utilize small reapers or hand sickles in the harvest. Although larger farms employ modern machinery, a common means of threshing involves the driving of horses over fenced earthen threshing inclosures.

Indian corn, indigenous to Chile, is produced chiefly for forage purposes. The Central Valley Sub-region grows most of the Chilean

crop. Planted from September 15 to late October on newly plowed land, the crop finds less favorable conditions than wheat. Cool nights constitute a major handicap to its culture. Fields never exceed more than a few acres. The crop may be husked by hand or grazed by work animals and other stock. A little may be ground into meal, some converted into *chicha,* but the greater portion is consumed as feed.

In contrast to corn, barley finds excellent conditions for its production. On the whole, however, it contributes little directly to the food supply, for most of the crop is used for the manufacture of beer; some goes to foreign markets. Almost wholly a cash crop, it is grown near the large cities and chief ports. The bulk of the output comes from a small area in the northern end of the Central Valley and the adjacent coastal strip.

Among more intensively cultivated crops, beans, peas, chick peas, and lentils, staple foods for the masses, occupy a place in the rotation of crops like that of corn, and grow on a considerable part of the land. Though consumed in large quantities, potatoes hold small acreage because of high yield. In addition, a variety of truck and garden crops of semi-tropical and temperate types grows throughout the year. Irrigated land frequently yields four crops of vegetables in one year.

Enhancing the Mediterranean aspect of the region as well as the marked similarity of conditions to those in parts of California, fruit culture plays an important rôle in the agricultural economy of northern Middle Chile. The long growing season, free from extremes of heat or cold; abundant sunshine; deep, fertile, well-drained, sloping alluvial lands; and irrigation water applied when needed—all favor the production of a diversity of sub-tropical and temperate fruits of excellent quality.

With more than 12 per cent of the land in crops, making it second only to wheat in areal extent, the grape leads other fruits of the Central Valley Sub-region. Depending almost exclusively on irrigation, the vineyards generally occupy favored sites on sloping piedmont plains. The productiveness of the vine accounts for the fact that many large as well as small landowners keep most of their properties in grapes and grow only such minor crops as are necessary for food and feed on the *haciendas.* Although during the season the consumption of fresh grapes is large, the bulk of the crop goes into

wines of various grades. Annual production amounts to some 40,000,000 gallons. On most estates comparatively modern methods prevail.

For the local needs of almost every estate, orchards produce a number of fruits—lemons, oranges, quinces, figs, peaches, apples, pears, cherries, plums, avocados, and small fruits. While direct use disposes of the bulk of the product, quantities are canned, and from 1,000,000 to as much as 4,500,000 pounds of dried fruit

FIG. 66. PURE BRED BULL FROM THE UNITED STATES

Several owners of large *haciendas* are improving their stock by importing high-grade animals and giving them the best of care; Magul farm near Santiago.

are prepared each year, for which the hot, sunny and rainless autumn proves ideal.

Though the livestock industry forms an essential part of agricultural practices on nearly every farm, the value of land for crops and the small area of suitable grazing territory relegate stock-raising to a subordinate position. This holds particularly in the drier portions of the Central Valley Sub-region. Grown largely under irrigation, alfalfa, red clover, and vetch furnish the chief hay crops and supply the best forage. In addition, natural range supports many herds. During the rainy season a sparse growth of grasses lends verdure to the landscape, but the drought-resistant green *Atriplex semibaicata*, similar to North American greasewood, provides the year round, the best forage between the Coquimbo and Maule Rivers.

Approximately one-third of the cattle of Chile graze on the Central Valley Sub-region, where they provide the domestic supply of feed and dairy products as well as the prevailing means of short-distance transport (Fig. 66). In consequence every *hacienda* has its quota. Irrigated alfalfa and clover fields, native valley and mountain pastures, and mild, open winters promote year-round grazing. In early spring, herds of cattle, horses, and sheep move to the mountain pastures, whence they return to the valley when winter rains have revived forage resources in the lowlands.

In general of medium-grade mixed breeds, sheep are of considerable utility in several ways. In addition to the important supplies of meat and skins obtained from the animals, a large part of the rural population makes its woolen clothing from the fleeces of small farm flocks.

The Coastal Valley-coastal Mountain Sub-region.—Despite the similarity of agriculture, conditions of relief and climate separate the coastal valleys from the Central Valley. Paucity of arable land strikes the keynote with regard to use of land; the area includes the many small coastal valleys and both slopes of the coastal ranges form 30° S. to 38° S. Despite heavier rain than in the east, irrigation is necessary over much of the land. Wheat, barley, grapes, beans, potatoes, and alfalfa preponderate in acreage. The drought-resistant character of barley renders it suitable for the semi-arid hill lands, where, as with wheat, it may grow without irrigation. Irrigation of vines becomes optional towards the south.

As to animals, their adaptation to the semi-arid, scrubby, rough hill pastures accounts for the numbers of sheep, goats, and mules. For cattle and horses, the native pastures provide meagre forage. As a rule, each large estate attempts to produce nearly all the products of farm and range required by the population, for the isolation of the many small coastal valleys limits intercourse with neighboring districts.

The Humid Pasture-Crop-Forest Region of South Middle Chile.—Part of Middle Chile in significance as an area of relatively dense peopling and important agricultural production, the Humid Pasture-Crop-Forest Region deviates widely from the type of economy characterizing Mediterranean Chile. Not only do its boundaries, but also crops, animals, and related industries, differ notably from those to the north. Hemmed in on east and west by the forests clothing the lands

about the Coastal Ranges and the lower Andes, the region owes its individuality to the rearing of livestock—an activity most conspicuous near the large towns—the production of temperate crops, and the amount and utilization of land in forests. Crops occupy less than one-seventh of the total area. The common method of procuring farm land has involved burning of the valuable pine-beech-cedar forest, principally in the north and to a lesser extent in the swampy south. The intervening lands, the Frontera, remain largely the domain of the Araucanian and his small forest clearings.

Cool summer and mild winter, fairly long growing season, abundant precipitation throughout the year, fertile soil, and gentle relief favor the cultivation of the hardier cereals, vegetables, and fruits. Of these, wheat, oats, and potatoes assume special significance.

Excluded to a certain extent from the section about Puerto Montt, where the wet summers prove harmful, wheat grows over most of the area. With 35 per cent of land in crops devoted to its cultivation, it ranks first. The principal varieties include soft white wheats and types resistant to moisture and rusts. Commonly the crop serves for the first planting on new clearings, where virgin soils covered with ashes give high yields. Sowing takes place from May to July, at the time of maximum rainfall. The soil receives little preparation. The end of December generally brings the harvest, although in the south excessive rain and cloudiness may retard ripening.

By virtue of the moist cool climate and friable loose soils, factors hindering the production of other crops, the potato enjoys particular popularity in South Middle Chile. The major concentration of cultivation is in the humid far south, notably on the island of Chiloé. Although the tuber grows in many parts of Middle Chile, the southern portion has more than half the acreage. It constitutes the principal staple food crop in many districts and a small part may be fed to cattle. Many varieties yield well, affording some 150 bushels per acre.

Like the potato, oats are well adapted to the cool moist lands of this region. Almost 80 per cent of the acreage planted to this cereal in the republic lies in South Middle Chile. In addition to furnishing the chief feed for horses and oxen, it affords a considerable surplus for export, most of which goes to England.

An important element of the diet of the lower classes, field peas,

the dominant leguminous food crop, are grown to a large extent. In rotation the crop usually follows potatoes and wheat. Planted in spring as soon as the danger of killing frost has passed, the peas are harvested with a sickle and threshed by horses.

As in Mediterranean Chile, fruits, also, are in wide vogue. Most of the temperate fruits are grown, but the apple, which vies with grape and peach as the most appreciated fruit in Chile, finds especially suitable conditions in the cool moist region. Early introduced by the Jesuits, it was soon spread by them and the Indians quite generally between 38° S. and 41° S. The larger part of the output comes from small farm orchards or solitary trees scattered about fields and woodland pasture. The trees receive only desultory care.

Various hay crops, including crimson and white clover, vetch, and marsh grasses, rank next to oats among the cultivated feed crops. Small open grasslands and woodland pastures, however, supply most of the forage for livestock.

Generally in relatively small groups, cattle, horses, sheep, and swine form an important part of the farming system. Here graze nearly two-fifths of all the cattle in Chile. Nowhere is a large beef industry developed; only a few steers sold now and then to local butchers provide meat in fresh or dried form. Descended from the old Spanish Creole stock, the cattle make neither prime beef animals nor good dairy stock; many have been bred solely for draft purposes. Although interest in production of cattle for meats still holds first rank, dairying has advanced more in this region than in any other section of the country. The industry has half the cows milked and manufactures three-quarters of the butter of Chile. The large German element in the population about Valdivia and Puerto Montt has contributed greatly to this development. Favoring physical factors comprise (1) the luxuriant growth of forage under the heavy rains and (2) the low temperatures promoting production and keeping of milk and the manufacture of butter and cheese. In addition, the important crops of hay and various legumes provide valuable winter feed. Most cows milked are of native stock with some Shorthorn blood; a few establishments have Norman cattle. Virtually all the manufacturing of butter and cheese takes place on the farms. Primitive and often unsanitary methods result in the production of an inferior article. Despite the highly favorable physical conditions, the

industry progresses slowly, owing to the lack of modern methods and improved breeds of stock and the inadequate means of transportation.

Although flocks are maintained in all parts of the valley and on the mountain slopes, sheep are less prominent than in the north or in the far south. The practice of permitting the flocks to follow cattle from

Fig. 67. Inside an Araucanian Home

Many people in the Central Valley supply most of their wants by household industries. (*Photographer unknown.*)

pasture to pasture causes a high mortality because of the ravages of internal parasites. Water-soaked terrain, dense forest undergrowth, cold winter rains, and the tick augment the list of handicaps. Nevertheless, every farm supports a few sheep. The wool is the basis for a common household occupation among the poorer classes, the products including clothing, blankets, and ponchos. One-fourth of the entire clip enters this industry (Fig. 67).

Swine thrive in the forests and woodlands. A few droves of good

breeding stock have been introduced, but most of the animals consist of native breeds of inferior type. As a rule they are allowed to root for themselves in field, pasture, or forest.

FOREST INDUSTRIES IN MIDDLE CHILE

Comparatively unimportant in comparison with agriculture in Middle Chile, the exploitation of the forests of the southern districts has distinct significance to the country as a whole. While in early days trees in the lowlands frequently meant merely an obstacle to be removed by burning in preparation for cultivation of the soil, gradual evolution has given an industry of note. In Chiloé and about Puerto Montt utilization of the forest dates from colonial times. As early as the opening years of the eighteenth century, the inhabitants of Chiloé built up a flourishing lumber industry which passed from their island to the mainland in a short time. The wood most eagerly sought was that of the magnificent *alerce*. Later Puerto Montt gained the leading position. Valdivia also grew up about a significant grouping of sawmills and tanneries, the latter using the bark of the *lingue*.

Originally covering most of South Middle Chile, the forest still occupies approximately one-half of the land. Each farm has its woodlot and some landholders control vast timber holdings in these valuable forests. The farmers who annually clear considerable areas by cutting or burning their forests for wood or for crop and pasture land furnish a large part of the total production. A few companies own mills together with timberland and contract with crews of woodcutters. Generally, however, the mill-owner prefers to purchase cut logs or lumber delivered at specified shipping points by the farmer. The labor required in obtaining the wood tides the farmer and his equipment over the slack winter season. At this time, the logs go to small portable farm mills which move from point to point as logging advances. Rainy weather and wet soil make transportation of timbers out of the forest difficult. From the mill, the lumber moves to the shipping center by cart, rail, or water, and thence to the various consuming districts of Chile. Though the cities and mines of the country buy quantities of foreign timber, particularly Douglas fir from northwestern United States, domestic varieties have begun to gain a firm grip on Chilean markets, owing to quality as well as to lower prices.

EXPLOITATION OF MINERALS IN MIDDLE CHILE

In addition to its wealth in agriculture and forests, Middle Chile possesses exceptionally valuable mineral resources. Though as yet few enterprises have undertaken operations, the riches of the Andes and of parts of the Coastal Range promise noteworthy development both in supplying foreign markets and in enabling the establishment of a domestic industry.

Particularly numerous in the departments of Coquimbo and Aconcagua, mines of copper, iron, gold, and silver have long been worked both in the Andes and in the Coastal Ranges. The most productive mine of Middle Chile, however, lies at the Teniente mines of the Braden Copper Company, east of Rancagua and about 100 miles southeast of Santiago, in a region of extreme ruggedness. As in the great Chuquicamata and Potrerillos mines of the Chilean Desert, the district has undergone remarkable development in recent years. Plant equipment has involved an outlay of millions of dollars; the mill capacity is 10,000 tons of ore per day. Operations are beset with difficulties. At an elevation of 8,000 feet and in an inhospitable section of the Andes, the mines are connected with the Longitudinal Railway at Rancagua by a narrow-gauge line 43 miles long. The heavy snows of winter frequently cause disastrous snowslides, so that the ore is hauled about a mile to the concentrating plant by locomotives which run almost the entire distance on tracks covered with snowsheds. Other than copper, exploitation of metal deposits is of little importance in Middle Chile, but there exists latent opportunity for marked development.

With respect to coal, Middle Chile, more fortunate than any other section of South America, has the principal deposits of coal of the entire continent, with mines located chiefly about Coronel, Lota, Curanilahue, and Lebú, all a short distance from the city of Concepción. Annual output averages about one and one-half million tons, approximately one-half the domestic consumption. As yet expansion continues slowly; the sub-bituminous coal suitable for use on railways and steamships does not make coke. In addition, the ease of handling petroleum to be used in the huge mining plants of the north and the abundance of potential water-power retard coal production.

MANUFACTURING

For the needs of its several million inhabitants, Middle Chile has a relatively important manufacturing industry. In some lines, the region has the most advanced enterprises of all South America.

Though both coal and iron are available for Middle Chile, basic metallurgical industries concerned with iron and steel are practically

FIG. 68. POWER PLANT AT COYA

The numerous streams fed by the snows of Cordillera provide enormous power resources for Middle Chile; a great development of this resource will revolutionize life and industry in the most important part of Chile. (*Courtesy of the Braden Copper Company.*)

non-existent. Early attempts at smelting were abandoned because of the shortcomings of domestic coal. Now the high-grade hematite deposits of the two hills at Tofo near La Serena furnish more than 1,000,000 tons annually for smelters in eastern United States.

Establishments based largely on the rawstuffs of agriculture and the forests, however, are numerous—flour mills, breweries, *bodegas*, refineries, textiles, furniture, tanneries, and shoe factories. Some 7,000 industrial plants employ more than 80,000 hands. Santiago,

Valparaiso, Concepción, and Valdivia near raw materials, power, and markets, carry on the bulk of the fabrication (Fig. 68).

The progress of the shoe industry in particular shows the trend of Chilean manufacture. Whereas before the World War, imported shoes dominated Chilean markets, at present the domestic product has almost entirely displaced others. The important tanning industries at Valdivia supply the leather, and skilled laborers in the major urban centers turn out an excellent article. Notable progress has taken place also in textile, electro-technical, and chemical industries. Woolen manufactures especially have an important grip upon domestic trade, while the beginning of large-scale utilization of water power permits the rise of the last two activities.

Several factors favor old and foster new industrial establishments. Among them are an abundance of raw materials, cheap hydro-electrical energy and coal, a small but increasing number of skilled laborers, a recent favorable attitude of wealthy Chileans toward investments in factories, a rising standard of living, and a small but compact market area.

MIDDLE CHILE IN PERSPECTIVE

Middle Chile embraces elements characterizing most of the advanced lands of the world. Over most of the habitable area, climatic conditions foster both agricultural development and human comfort. Fertile soils yield a variety of products. Considerable fertile soil in South Middle Chile still awaits cultivation. Agricultural production also may be increased materially by bringing under the plow idle lands of vast estates of the Central Valley and by better and more modern methods of culture. Forest resources are exceptional among those of South America in practicability of utilization at the present day. Mineral deposits hold untold wealth; coal and rushing mountain streams guarantee power for industry. The fortunate blending of Araucanian, Spaniard, Italian, German, and Dutchman has contributed to the evolution of a healthy progressive people.

In contrast, Middle Chile bows to its major handicaps of huge *haciendas,* isolation, and present national regard for the desert resources. Reverses in the industries of the north initiate a quickening of interest in the development of the various resources and districts of Middle Chile. East of the great Andean wall, however, the vast

plains of the Paraná basin and the rich realm of eastern Brazil attract more strongly the European immigrant. The concentration of population in these extensive lands by the same token connoted the rise of industry and the minimizing of future prospects for this section of Chile. Nevertheless, the start already achieved by this portion of Chile signifies a future Middle Chile evincing a regional economy in certain respects resembling those of the highly specialized small nations of Europe—Switzerland, Belgium, Holland. As such it is unique among the natural regions of South America.

CHAPTER XI

THE CHILEAN DESERT

Outstanding among desert regions of the world, North Chile produces an annual wealth far surpassing that afforded by many more extensive agricultural lands, even those in an advanced stage of economic development. To the republic of Chile, the barren expanse, stretching from 30° S., about La Serena, to the Peruvian border, has contributed a vital resource. Without the revenue yielded by the minerals of North Chile, the middle portions of the country could never have attained their present world significance. For the retention of the desert, Chile has shown willingness to resort to military force at any time, if necessary.

From the standpoint of human response, little may develop other than what has already evolved, owing to the comparative simplicity of natural conditions. The land has great mineral riches but few stretches of agricultural value. The region consists of a coastal range strip, an interior zone of *pampas*, and the Andes. Over all reigns the blight of aridity. With corresponding uniformity, life conditions are unfavorable. Violent earthquakes in the north add to the list of difficulties. Except for the population to handle the produce of the mines and nitrate fields or to serve as ports for landbound Bolivia, the region supports little besides tiny clusters of habitations closely bound to watering places. On the whole, the land is far less attractive than the coastal desert of Peru, for few streams pierce the Coastal Range. Only at the extreme north and in the deeply incised filament of green afforded by the Upper and Middle Rio Loa does an attractive aspect like that of the Peruvian Coastal Valleys break desert unity. In actuality, however, the coast shows a string of settlements, one of which, a bustling center, boasts a population of more than 50,000; a second port has almost 40,000. The reasons are many.

Population Distribution.—Almost exclusively, the significant communities have arisen in consequence of mineral exploitation. Those that do not owe their origin directly to mineral resources—Tacna,

Copiapó, Calama, Huasco—have acquired relatively little importance. They supplied early laborers, but population has concentrated at points more favorably situated with regard to deposits or shipping centers. In the interior, a similar situation holds. Wretched little villages dating from Inca days remain wretched little villages. Aptly they have been termed "out-of-the-world" settlements.

Population, both in composition and distribution, reflects the influence of the mines as contrasted with that of agriculture. The proportion of Indian blood is especially large. In the mines and over the highland stretches, the indigenous strains prevail to the near exclusion of European blood. The emigrant of Spain or Italy has little to attract him in mining enterprises, and agriculture is restricted. The interior lands over much of their area support a scant sprinkling of peoples; the Desert of Atacama is among the most barren territories of the world. Wherever sufficient water is available for agriculture, however, settlements have arisen. These centers play a vital rôle in provisioning both the mines and the larger coast centers which depend rather on the mineral industries for economic existence. The oases lie in two principal districts, one from the Rio Loa settlements northward, the other south of the area about Rio Copiapó. The two zones are separated by nearly four hundred miles of land supporting no agriculture—the Atacama Desert. The northern oases resemble those of the Peruvian Coastal Desert and support a few small towns. In the south the major populations group about Copiapó, Vallenar, Huasco, and La Serena. Though the four-hundred-mile desert stretch boasts no agriculture, it holds a large portion of the population of North Chile. Antofagasta, the chief town of the region, stands fourth among the cities of Chile. A lively, modern development, it has great value as the port for the enormous copper output of Chuquicamata and as the leading shipping point for Bolivia; a Bolivian custom-house is maintained there. Though within the more or less agricultural section of the north coast, the second city of the region, Iquique, also depends chiefly on minerals, especially nitrate. Its 40,000 people have gathered almost solely in response to this one industry (Fig. 69).

Transport Facilities.—As is the case in most of Chile as well as in Coastal Peru, the sea is the main highway from port to port, despite the paucity of even fair harbors. The Longitudinal Railway extends

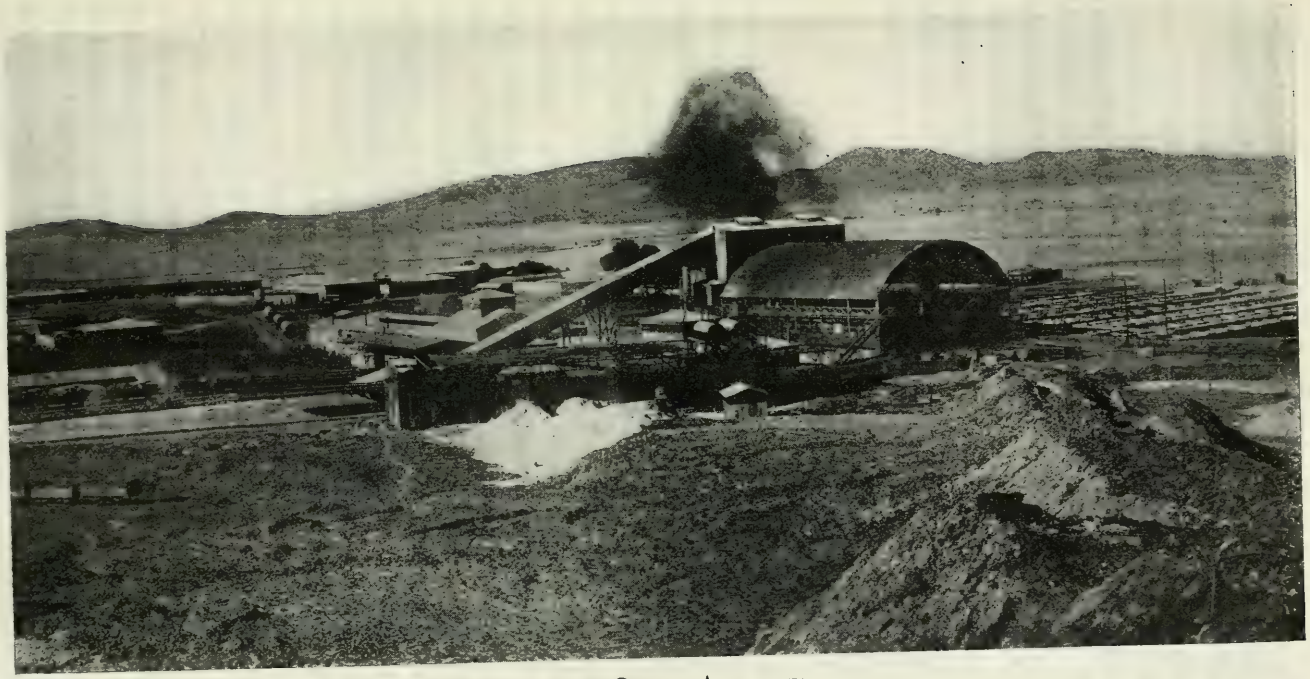

FIG. 69. OFICINA ACONCAGUA

A nitrate *oficina* is a huge establishment with crusher, conveyor, boilers, settling tanks, and all the outlying buildings for machinery, animals and laborers; in the distance level *pampas* and groups of bare isolated hills. (*Courtesy of the Lautaro Nitrate Company.*)

far north, but available traffic pays only a small fraction of expenses for maintenance. In contrast transverse lines dominate. That leading inland from Antofagasta and tapping nitrate pampas and Chuquicamata, and extending on to Bolivia holds great commercial value; a similarly international line, from the coast to La Paz, Bolivia, has accounted for the growth of Arica. Yet most of the area lacks ready means of transportation, other than pack trains. Not only are physical conditions for construction and upkeep troublesome, but much of the land has no actual need for such services. To many of the mineral developments, however, adequate transportation constitutes a supreme requirement for moving output as well as for carrying the necessities of life; the desert can be relied upon for little sustenance.

THE DESERT

While the continent of South America embraces only a small area of arid desert in comparison with other continents, its almost rainless lands of the west coast, particularly in Chile, display a scarcely rivalled desert aspect. From the sea the naked coastal range rises to heights of 4,000 to 6,000 feet. Beyond, a level to gently rolling surface of sands, gravels, bare rock ridges, pebble pavements, and *salars* stretches to the foothills of the Andes; here lie the great nitrate deposits. On the east, the Andes rise in a broad and somewhat regular slope to an average elevation of 13,000 feet, culminating in peaks exceeding 20,000 feet. A small portion of the Puna de Atacama also forms part of the region. Of the many streams which flow down the flanks of the eastern mountains, less than one-half dozen reach the Pacific; their waters disappear in the deep, porous, piedmont, alluvial plains or in the thirsty air. Here the lack of exterior drainage has fortuitously contributed to the great accumulations of nitrate and associated deposits. Between latitudes 19° S. and 28° S. in a distance of more than 500 miles, only one river reaches the sea—the Rio Loa, a permanent stream which furnishes irrigating waters for several agricultural districts, copper camps, nitrate *oficinas*, and coastal cities. To obtain water supplies for various enterprises, several highly expensive developments have been completed. Antofagasta and Iquique derive their public needs through pipe-lines 230 miles and 150 miles long respectively, as is the case also with numerous

nitrate plants which require plenteous water in the various manufactory processes.

Most striking among the physical factors is aridity. Nowhere does annual precipitation exceed 10 inches. Much of the area may be regarded as the most arid region in the world. Iquique records an average of one day of rain per year. Years elapse without any precipitation. Paradoxically, however, sea-breezes may produce a bank of clouds which frequently hide the slopes of the coastal ranges at elevations between 2,000 and 4,000 feet. Known in the coastal desert of Peru as the *garúa*, here this phenomenon is called the *camachanca*. For a large part of the region, mean monthly temperatures are well above 50° F, with a small annual range. Intense insolation and rapid radiation cause a marked change between day and night temperatures.

While the arid deserts of the world in general support a certain amount of vegetation, however scant, extensive tracts of North Chile lie absolutely bare of plant life. Mile upon mile may be traversed and only the browns and yellows of the gaunt slopes and glistening lonely pampas greet the eye. To the wayfarer, the living green of the oasis has a keenly exhilarating effect. Well do these patches of luxuriant growth exemplify the insular character of oases. The most developed stands of natural vegetation come in the upper regions of the Andes and in various portions of the interior pampas where a high water table along a stream course or about a salt pan affords a meagre supply of moisture. In some cases, as in the pampa of Tamarugal, an area lying between Pisagua and the Rio Loa, ground water may suffice for a growth of various *mimosae*, principally, *Prosopis tamarugo*, a form practically exterminated in consequence of its occurrence in this wood-starved region. With the ascent of the Andes, moisture conditions improve and in a zone of some 8,000 to 10,000 feet a belt of short grasses clothes the ground, a type of high pasture eagerly sought by the herders of North Chile. The nutritious growths of the lower portions give way to more alpine types such as the *ichu* grass, a type of bunch grass, and various mosses and resinous shrubs. The resinous *tola* bush provides a valuable fuel. In addition to the plant life of favored districts of the interior pampas and of the Andes, North Chile has a zone of herbaceous growths in the far south, from Copiapó towards Middle Chile. Here the ephemeral growth occasioned by winter showers, a growth quickly covering the land with

verdure and almost as quickly disappearing, contributes to the existence of grazing by hardy livestock.

The Oases.—Though of conspicuous significance as nuclei for the growth of population, in actual importance the oases are far in the shadow of the mineral interest of North Chile. The agricultural lands send their men to work in the mines and supply quantities of foodstuffs and work animals, but on the whole they are quite incidental so far as the mines are concerned. The magnitude of engineering operations in nitrate field and copper camp with comparative ease could dispose of the problems of labor and foodstuffs if there were no oases in relatively convenient proximity.

The desert embracing about 40 per cent of Chile has only 5 per cent of the irrigated area and 7.9 per cent of the pasture land, nine-tenths of which is brush hill land with sparse vegetation of low carrying capacity. Of the region as a whole only .02 per cent grows crops and only 2.3 per cent supports pasture.

Three types of oases characterize the region. (1) In the north the several irrigated valleys of Tacna, until recently part *in toto* of Chilean domain, closely resemble the agricultural districts of the coast to the north. Here latitude permits the production of a diversity of subtropical and temperate products, as is the case also farther south, to and including the six major Rio Loa oases. Tacna produces among others olives, figs, sugar cane, cotton, dates, and citrus fruits. (2) The oases of Copiapó and Vallenar and near-by lands differ from those of the north, both with respect to their size and their products. The south has four-fifths of the irrigated land of North Chile and produces chiefly feed and food for the mineral regions of the north. (3) Of virtually no importance to the region as a whole, because of their intensively developed self-dependence, a few favored spots on the alluvial fans of the Andes constitute a third class of oases. At the northeastern extremity of the Desert of Atacama the most noteworthy of these has developed in a group about San Pedro, at an elevation of some 8,000 feet. San Pedro, like the smaller watered plots farther north, has one principal method of contact with the outer world, that of serving as a transit point. The herds of cattle which take the exhausting route across the Puna de Atacama rest at San Pedro before starting the last lap of the trek to Calama, a large Rio Loa oasis, and the mines at Chuquicamata.

On the whole, agricultural North Chile consists of small isolated irrigated valleys and piedmont oases, producing a variety of crop for local consumption and some surplus for neighboring mining camps and ports, in some cases providing also havens of rest for those engaged in traffic across the difficult lands within and contiguous to the region.

Alfalfa and corn grow on much of the cultivated area; fruits also hold a leading place in agricultural systems. First among the crops in acreage, alfalfa serves as a valuable forage and as dry feed for cattle, horses, mules, and asses, animals which constitute essential parts of equipment in oases as well as mining districts. Corn, at times yielding two crops per year, provides pasture and feed for livestock and also food for much of the population. It occupies about one-fourth as much land as alfalfa. Grapes are a third crop of more than ordinary import, from areal extent in the south, but from point of view of quality and reputation in the north.

Separated by broad expanses of sand, gravel, bare rock, and salt plain, the oases afford little chance for extension of cultivation. They possess only a restricted quantity of water at best, a supply which varies greatly from year to year. During serious droughts, lands generally farmed or pastured may be entirely abandoned. Attempts to increase the area in crops have met with little success. Restricted irrigable land, small water supply, and poor transportation facilities denote permanently small, stagnant and self-dependent communities.

MINERAL INDUSTRIES

Whereas in respect to population and agriculture Middle Chile is virtually Chile, in point of present commercial strength North Chile towers far above the fertile regions to the south (Fig. 70). One commodity produced entirely in the desert area and a second obtained principally in the mines of the same region compose more than three-fourths of the value of Chilean exports. In addition to these two—nitrates and copper—North Chile ships quantities of other minerals and mineral by-products; borax, iodine (Chile controls world trade in this by-product of the nitrate industry), iron, as well as the precious metals, are sent to the world markets in significant volume. Scarcity of fuels constitutes the one great deficiency. Without its mineral wealth, North Chile would represent primarily one of the least

populated zones of the world, while the country of Chile would consist essentially of a progressive agricultural land seriously hampered as a whole by the paucity of cultivable area.

The Metallic Minerals.—From early dominance among the mineral industries, the exploitation of precious metals now occupies a quite subordinate place in the interests of the region. Among these riches, silver experienced the greatest development. This metal gave origin to several towns which in later days turned their energies to other

FIG. 70. COPPER PLANT AT POTRERILLOS, CHILE

The new large-scale development at Potrerillos, as at all camps in the Chilean Desert, calls on the outside for everything used in the industry.

activities. Though output is small, the region has widespread deposits, indicating a lasting significance for the industry.

Copper.—In contrast to silver, copper has had a meteoric rise to great importance. In early days the industry depended upon numerous small-vein mines of high-grade ore, deposits widely distributed in the Coastal Ranges and in the Andes. With the construction of the first reverberatory furnace, Chile gained means for the huge-scale production of copper, since the new method effected the smelting of sulphuric ores, of which the region has enormous stores. Previous to this process, the Indians and Spaniards had smelted only the rich carbonate and oxide deposits which occurred near the surface. Hundreds of these small-vein mines, now abandoned, can pay handsomely with the furnishing of adequate equipment and transportation facilities.

Various factors—exhaustion of richer veins in the coastal zones, scarcity of labor owing to expansion in nitrates, lack of transportation facilities, and competition from United States copper—prevented growth in the nineteenth century following the first spurt succeeding the introduction of the new manufacturing process. With 1915 as a base, the industry suddenly leaped into vigorous activity, under the stimuli of war demands for copper and noteworthy technical improvements facilitating utilization of lower grade deposits. So that in 1928 the region produced 184,960 metric tons of copper.[1] This total, plus that of Middle Chile, places Chile second among the countries of the world producing copper. The major developments of North Chile comprise those of Chuquicamata and Potrerillos.

At Chuquicamata, about 14 miles north of Calama and 5½ miles from the Antofagasta-Bolivia Railway, lie the most extensive copper deposits of the world. Most of Chuquicamata Hill, which covers an area of 2½ by ⅓ miles, consists of shattered rock so thoroughly mineralized that the entire mass is considered workable ore. Huge charges of explosives (one in 1925 totalled 438 tons of dynamite and black powder which blasted more than 900,000 tons of rock) eat into the eleven different levels of the workings and steam shovels load the ore into railway cars (Fig. 71). Moving down grade, the cars carry the ore to tremendous crushers.

The enormous production of Chuquicamata is made possible by the large-scale method of obtaining and handling the ore and by recovering the copper from oxide ores through leaching and electrolysis. Then the copper, melted and cast into bars of superior quality, commands a premium as a base for copper wire and electrical supplies. Annual capacity totals 187,500 tons, yet the known and potential reserves of 688,000,000 tons of surface oxide and deeper sulphide ores, averaging 2.12 per cent copper, are enough to last for a century at double the present rate of production.

The developments at Chuquicamata represent a remarkable achievement in the face of great handicaps. To overcome the conditions of location in the desert, the American interests owning the deposits have made huge expenditures. Fuel and structural materials

[1] Copper production in metric tons 1928:

Chile Copper Co. (Chuquicamata)	132,931
Braden Copper Co. (Teniente—Middle Chile)	109,137
Andes Copper Co. (Potrerillos)	52,029

come from distant fields and factories. Electrical power generated at a huge plant on the coast at Tocopilla is conveyed to the distant mines by a high tension system; fuel consists of petroleum from California or Northern Peru. Labor comes from Middle and North Chile as well as neighboring countries; food moves from diverse places, including the plains of eastern Bolivia and northern Argentina, which supply beef on hoof; fresh water flows through pipes some 70

FIG. 71. CHUQUICAMATA COPPER WORKINGS

Six of the eleven levels at Chuquicamata Hill, where huge charges of dynamite break up the rock hill into bits that can be handled by steam shovels.

miles from the high Andes and salt water for leaching plants from points 40 miles distant.

The Potrerillos mine in the department of Chañaral is likewise an enormous enterprise of more recent development. Prior to any production, some $40,000,000 were spent in providing a railroad from Pueblo Hundido, 65 miles of water pipes, a 15,000-ton concentrator, a huge smelter, an electric generating plant, and a model town for 5,000 inhabitants. The rapid growth towards total capacity of 90,000 tons of copper per year has markedly augmented Chilean exports. A body of 100,000,000 tons of ore, largely sulphides, averaging 1.4 per cent copper provide a reserve for a third of a century of operations on the present scale.

The future of copper in Chile does not depend entirely upon the development of large deposits of low-grade ore. Hundreds of small vein mines, abandoned years ago, would pay handsome dividends if reopened and properly equipped. The recent building of new railways has increased the potential value of these old mines. But while they may in time add materially to the copper export trade, it is the low-grade disseminated deposits which will undoubtedly supply the major portions of the output and will continue for some time to place increasing quantities of high-grade copper in the markets of the world.

A second mineral of growing importance to North Chile is iron ore. After various attempts to develop a domestic iron and steel industry based upon local ores and the coal or wood of Concepción in the south, the plants ceased operations, and the chief deposit of high-grade iron ore at Tofo near La Serena was leased in 1913 by an American firm. The completion of the Panama Canal made the Chilean ore deposits available for the steel industries of the United States, so that at present the Tofo district ships more than 1,000,000 tons of ore per year, and Chile holds first place among the countries of South America producing iron ore.

Mining and shipping have involved little cost following installation of facilities. The ore, extremely compact and free from impurities, consists largely of excellent hematite. The ore body caps two hills. Only a thin and patchy loose soil supporting a sparse vegetation of cacti and the like, constitutes the gangue between the ore boulders of the surface. Practically free from the dikes of barren igneous rock in the terrain, everything quarried reaches the crusher, whence, by electric railway, it moves to a huge basin dock in the artificial harbor dug in solid rock at Cruz Grande.

NITRATES

Commercial peer of all other commodities produced by Chile, nitrate means even more to the country than coffee to Brazil. It serves as an effective index of the economic situation of the country. A decrease in activity in the industry causes a drop in total imports, an exodus of thousands of the 65,000 workers formerly directly engaged in the nitrate fields, a curtailed production of Middle Chilean plants which sell their wares to the desert lands, reduction in agricultural shipments from the more southern area, and feverish efforts

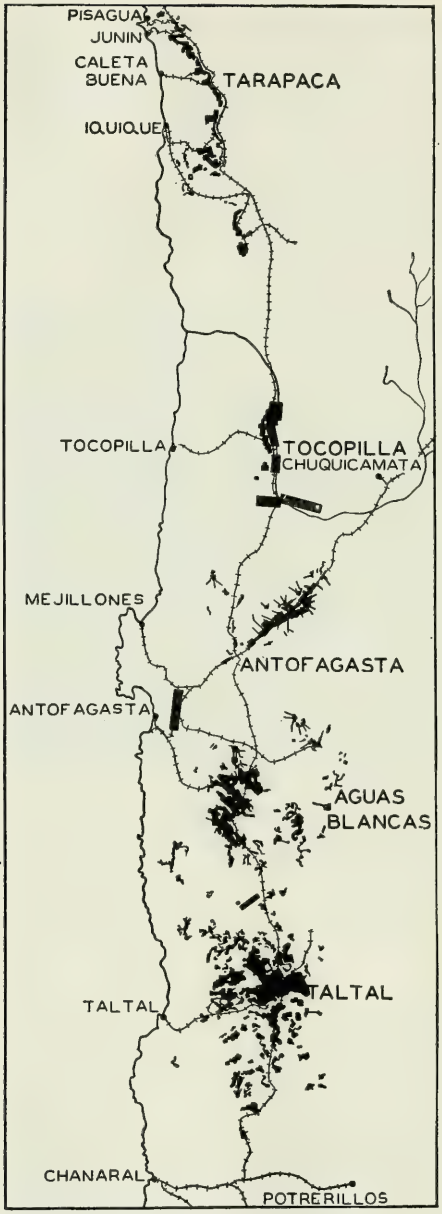

FIG. 72. NITRATE ZONE OF CHILE

The five major producing districts lie in the zone from 19° south latitude, near the port of Pisagua, to 26° south, a short distance north of Chañaral.

on the part of the Nitrate Producers' Association to ameliorate the situation. In contrast, a large demand for nitrate, a rare occurrence in late years, brings plenty and prosperity to all parts of the country. The export tax on nitrate has supplied for one-half century more than half the national revenue.

The rise of Chilean nitrate to a rank as one of the world's leading commercial products has devolved upon its ability to help maintain the fertility of the impoverished soils of Europe and southeastern United States and upon its utility in many industrial processes. With the evolution of military explosives it became an essential factor in the World War. The only large natural nitrate deposits of the world are those in the Chilean Desert; and since, until recent years, the production of artificial nitrates has been small, the Chilean commodity has dominated world markets and prices, a situation which came to an end in the decade 1920–1930.

The Nitrate Deposits.—In five major districts, the nitrate country extends in a long, much-interrupted strip from 19° S. to 26° S. (Fig. 72). Here on the western margins of the interior plateau have accumulated the great wealth of the Tarapacá, Tocopilla, Antofagasta, Aguas Blancas, and Taltal fields. The layers of the deposit consist of the nitrate stratum—the *caliche*, which varies in thickness from inches to 8 or 10 feet and contains a variable proportion of sodium nitrate and other substances—and the *costra*, a hard copping layer of sand and clay in some places covered with loose wind-blown material. The scantiness of exterior drainage has influenced the precipitation of the nitrates, but the exact manner in which this took place is a controversial point. Theories include deposition resulting from a formerly higher water table, formation by the decomposition of vegetal and animal remains, and fixation of nitrogen from the atmosphere.

For a long time following their discovery, the nitrate fields lay undeveloped. Their exploitation began in a small way following 1830 by Chilean operators and laborers in the Peruvian province of Tarapacá east of Iquique and in Antofagasta, then Bolivian territory. The war of the Pacific in 1878–1880 temporarily stopped the industry at Tarapacá, but at the same time it led to a development of the deposits in Antofagasta and Taltal. Cessation of hostilities permitted resumption of leadership by Tarapacá, although later extensions of rail have aided the rise of other fields.

As with the copper camps, a multitude of difficulties hampers operation of the nitrate plants or *oficinas*. In this barren desert everything utilized in the industry, except rock, sand, and gravel, must be carried long distances. For most of the *oficinas* fresh water must be piped a hundred miles or more from the Andes, and only in part of the region can salt water for treating plants be obtained from wells at feasible depths. Men, food, supplies, animals, feed, structural steel, timbers, machinery, and fuel from the outer world are brought here at considerable expense.

The Growth of the Industry.—Despite tremendous difficulties, beginning in 1880, when the holdings of Peru and Bolivia passed to Chilean control, production of nitrate increased from 250,000 metric tons to 2,785,000 tons in 1913 (Fig. 73). The end of this period, marked by overbuying, speculation, overproduction, and inflated values, was followed by the first of a series of crises. With the open-

ing of the World War the early drop in nitrate exports threw 50,000 out of employment in North Chile; about one-third of them were heads of families; practically all work ceased in the fields. Thousands of laborers moved to coast ports, where they slept on docks awaiting passage to Middle Chile or the irrigated valleys of Peru. Never before had reverses caused such an exodus. No quotations for exchange were listed in Europe for more than ninety days. The Chilean *peso* dropped from a value of 19 cents (1913) to 14½ cents (1914).

Then ensued a period of marked advances and disastrous reverses. The great demand for nitrates as raw materials and as fertilizers to increase food production brought exports to almost 3,000,000 metric

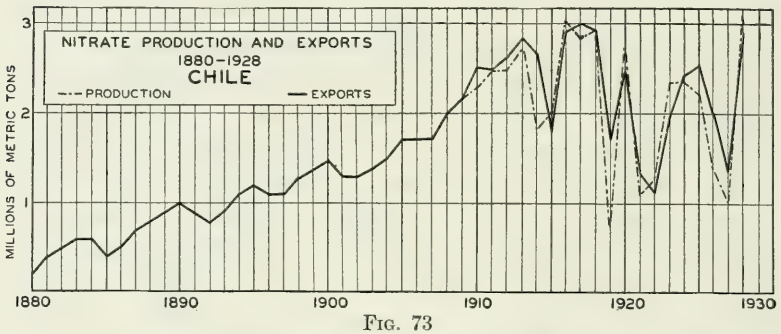

FIG. 73

In 1928 the nitrate industry made a remarkable comeback; can it maintain the high rate of production?

tons in 1916. Then followed two years of such shipments, but the close of the war caused a drop from 2,900,000 tons in 1918 to 900,000 tons in 1919. Another year of near normal activity and in 1922 exports dropped to their lowest figure since 1897. Recovery has been only partial.

The Life of the Industry.—The basic cause for the plight of the Chilean nitrate industry lies in the overburdening of the producers by various domestic influences, a situation which accelerated the trend in former consuming countries towards the production of synthetic products. In addition to the expenses of operating in the desert, the *oficinas* bear an export tax of some $10 per ton of nitrate. To date, the republic has effected no reduction in the tax, for the government considers this source of revenue absolutely vital to the country. To be sure, other measures designed to aid the nitrate producers have

been introduced, but the tax continues a major burden. Meanwhile, whereas in 1894 Chile supplied 73 per cent of the world demand for nitrates and in 1913–14 53 per cent, in 1927–28 the share was less than 20 per cent of the total, with prospect for further losses.

Securing insufficient aid from the government, the industry has turned to itself to determine how costs of production could be lowered. The early lack of serious competition caused the growth of a highly inefficient system of manual labor in working the ground. Moreover, sorting of the materials was done by hand, and the *caliche* carted to the concentrating plant. Under such methods, the handling of low-grade deposits proves impracticable. An attempt on a huge scale to effect economies in these respects has been initiated by a new plant which increases the amount of nitrate recovered from raw material from 60 per cent to almost 90 per cent. Centralization of manufacture will reduce overhead costs by one-fourth and prevent waste of fuel. Whether the new enterprise will prove only a magnificent gesture remains to be seen. With Germany, formerly the largest customer for the Chilean product, already producing almost twice as much tonnage of nitrates as Chile, and with other countries forging ahead rapidly in the field of synthetic forms, the natural nitrate industry will require a far greater stimulant than new methods at only one *oficina*. In addition it will require a material reduction in the $10 per ton export tax which has been vital to the republic. Face to face with the great crisis of the industry, will government officials reduce or, if necessary, remove the export tax on nitrate and import duties on necessary raw materials and, if not already too late, reset in motion the wheels of industry in the desert with huge fixed investments in plants, railways, ports, and cities dependent on nitrate?

THE FUTURE

A forecast of conditions in North Chile resolves itself essentially into a discussion of nitrates and to a lesser degree of copper. Moreover, such forecast closely approximates one that indicates the future status of Chile as a whole.

By the political manœuvre which gained for Chile the Bolivian and Peruvian territory now composing part of its domain, the country secured its nitrate fields, major copper properties, and the borax and iodine resources, riches from which the republic extracts fully three-

fourths of its total exports. North Chile for many years has provided most of the national revenue. Its industries have made possible the present commercial position of Chile and at the same time they led to the precarious situation in which the country now finds itself. For the benefit of the major groups of population, the shifts of interest towards Middle Chile which must come will prove advantageous (Fig. 74). The nitrate industry already flounders in a seemingly bottomless quagmire, not for want of nitrate reserves, for abundant

FIG. 74. TOFO IRON MINES NEAR LA SERENA

Without any other resources for a basic iron and steel industry, iron ores mined in the region will continue to move to other areas. (*Courtesy of C. A. Buck and the Bethlehem Steel Company.*)

deposits of high grade have not been touched, but because of heavy national trade tariffs, short-sighted manipulation of prices, shipments, and sales by the Nitrate Producers' Association, and cutting competition with synthetic nitrogen. However, the decreasing fertility of far-away green fields and blossoming orchards, calling for replenishment of plant food by fertilizers, may continue and even increase activity in the parched nitrate desert, paradox in infertility and rich promise for fruitfulness of other lands. With more efficient processes, better legislation, and rich fields untouched, the influence of natural nitrates may stretch far into the future.

Though for decades North Chile will continue to produce the bulk of Chilean exports, its metallic and other mineral deposits eventually

will be exhausted. As the stores of mineral wealth give out, a general exodus from the region and a gradual decadence as a whole will ensue. Isolated valley and piedmont oases enlivened by copper and nitrate exploitation will relapse into quiet, lonely, stagnant and self-dependent communities. The desert remains the critical factor in any future peopling of the region, and with only one significant river in a zone of more than 500 miles, the desert will hold its own as a parched repellent land.

CHAPTER XII

PERU

One of the most interesting and complex sections of all South America, Peru embraces an area of approximately 532,000 square miles of parched desert strips, cold bleak mountain ranges and plateaus, and hot humid lowland plains. It holds in its irrigated oases and isolated mountain recesses a population of approximately 5,500,000. The republic, like most other countries of South America, is severely handicapped by meagre transportation facilities, and a large proportion of Indian and mestizo population.

In over 85 per cent of the country primitive transportation facilities prevail, only 2,020 miles of railroads being in operation. No railway net exists; most of the lines consist of short isolated tracks of varying gauges connecting an ocean port with the chief towns and plantations of the adjacent, fertile, irrigated valleys. Only two systems—the Central and the Southern—extend from the coast into the elevated Andean region. Most of the Andean and Montaña regions still depend upon the slow and primitive means of river and pack-animal transportation. In the coastal desert no longitudinal railway connects the irrigated lands and no good motor roads traverse the barren stretches between the fertile valleys, so that, as a result, the ocean highway is utilized even for short distances.

Scattered along the 1,400 miles of coast line are thirty-five or more ports which handle the trade of the republic. Only nine major ports handle both imports and exports, but all may ship directly to foreign countries. Only four possess harbors which can be called even fair; the remainder have merely open roadsteads unprotected from the winds and the ocean swell. As a result steamers usually anchor a mile or more off shore and discharge or receive cargo and passengers by means of lighters and launches, a slow and rather inefficient means of transfer (Fig. 75).

Indians and mestizos constitute fully 82 per cent of the population of the republic. The country lacks a middle class to span the wide

gulf between the Indians and mestizos, who exist at the bottom of the scale of civilization, and the thin veneer of civilization embodied in the ruling class. The eastern lowlands are inhabited chiefly by many tribes of uncivilized Indians; and the highlands by Indians and mestizos, who eke out a bare living in the niggardly soil of the isolated valleys and high pampas. In the coastal desert, highly mixed mestizos provide the labor for agricultural operations in the irrigated valleys, and for the industries. The 600,000 whites in Peru, living

FIG. 75. TALARA HARBOR, NORTHERN PERU

In one of the good harbors cargo must be transferred by boat and barge; in the distance the bare, brown, desert hills.

mostly in the coastal cities and ports, constitute the ruling group as well as the controlling part of the industrial and commercial class. For the country as a whole nearly two-thirds (60 per cent) of the population is classed as inactive—indigents, invalids, aged persons, persons without work and children; this represents a vital drain on the active element.

Few areas in all the world disclose in such close juxtaposition the violent contrasts of desert, mountain, and plain, with their divergent ethnic groups and consequent social and economic responses. Coastal Peru possesses the drifting blinding sands of the Sahara and the blooming, sun-bathed, irrigated valleys of the Punjab or California; Highland Peru encloses the isolated valleys and bleak plateaus of a

Kashmir, and the snow-capped summits of the Himalayas; eastern Peru presents the jungles of a Congo or an Irrawaddy. Also, few areas exhibit a more interesting historical and economic evolution than this portion of South America.

HISTORICAL BACKGROUND

A conspicuous figure among the Spanish colonies, colonial Peru dominated South America. Reports early came to the Spaniards in Panama and Mexico of the untold riches of the Empire of the Incas, which included about 12,000,000 people at the beginning of the sixteenth century, more inhabitants than the area possesses at the present time. Peru was the rival of Brazil in the fifteenth, sixteenth, and seventeenth centuries. It held for a considerable time the most promising place among South American countries.

The Inca Empire.—The army of Spain in Peru did not consist of more than 400 men, but it took the Spaniards with their improved methods of warfare less than a decade to destroy the great Inca Empire, which extended from the Maule River in Chile and the Oasis of Mendoza to the northern Andes in Ecuador (Fig. 76). The development of the Empire was a result of a few highly gifted and masterful leaders and a combination of physical conditions that favored advance. Much of the Empire was isolated by effective topographical and climatic barriers from the Indians in other parts of South America; this isolation protected the people from war-like natives elsewhere and induced early permanent settlement in a given area. On the cold plateau work was not so disagreeable as in the hot lowlands to the east. In a treeless plateau, land was easily put under cultivation. On vast areas, lands unfit for tillage afforded good grazing areas. Two animals, the llama and the alpaca, native to these highlands, were among the few domesticated animals of the New World. They aided the primitive people in many ways. The metals of the highlands furnished materials for utensils and implements. Abundant stone supplied materials for buildings, granaries, roads, and canals. Living conditions in the highland zone were not as easy as on the tropical or temperate plains to the east. To live, people had to produce and save. Because of the uncertainty of precipitation, farming by irrigation on the rough, steep, and terraced lands developed a high degree of utilization. Temperatures, though mild enough to give

rather large yields under irrigation, required the preservation of food during the short winter period and during seasons of poor crops when an unsuspected frost in the middle of summer destroyed what promised to be a major yield. This protection by natural conditions and

FIG. 76

Nowhere did the Incas penetrate the hot humid lowlands or the temperate plains of Argentina.

the necessity of working and storing up food afforded the necessary conditions for the first steps of advance of a primitive people beyond the stage of savagery.

The Inca civilization which began in the tenth century developed along a number of lines; hills were terraced and irrigated to promote cultivation; lands were fertilized with guano and nitrates; all cultivated land was divided into three parts, one for the Priesthood of the Sun, one for the upkeep of the Royal line, and one for the support of

the people themselves; taxation was enforced in the form of cultivation of land; the lives of the people were so regulated that even the smallest details of domestic life were controlled by the state. Poverty and destitution were unknown; the old and infirm were cared for; grain and potatoes were stored in each village according to its requirements; each family was capable of making its own clothing. There was no coinage, gold and silver being the exclusive property of the state; no man of the lower classes owned anything. The Incas were skilled in metal workings, extensive construction, the building and maintenance of highways, textile weaving, and the manufacture of pottery. Nowhere did the Incas penetrate the tropical forest; neither did they develop the humid regions.

Colonial Peru.—A sedentary isolated population, arid conditions, excellent highways, the large enslaved class controlled by the small ruling class and dissension and civil strife in the reigning family shortly before the Spaniards came, favored rapid conquest and the development of the Spanish colonial system. The conquest of Peru under Pizarro began in 1530 and was virtually completed by 1535, except for subsequent consolidation of Spanish control within all of colonial Peru. Bolivia and the northwestern part of Argentina were known as Upper Peru; Chile was a "captaincy-general" of Peru.

In the early operations of the Spaniards on the west coast, Lima became the center of Spanish control, not only for Peru, but for all South America and developed certain traits which it retains at present. Connections with Spain were made easier by way of the Panama route and the settlements in Caribbean America, than by way of the east coast across the temperate plains of Argentina inhabited by nomadic, war-like tribes.

From the time Pizarro first set foot on Peruvian soil, until after the nineteenth century, mining industries dominated the country. After murdering the leaders of the Incas, taking their wives, and looting their homes and palaces of the gold and silver, which had been stored up by hard work and long efforts, the Spaniards enslaved the Indian population and put them to work in the famous mines of the highlands, especially in the Cerro de Pasco and Potosí regions. A stream of gold and silver flowed throughout colonial times from the Andean mines to the coffers of Spain. In general, mining methods were primitive, only the richer placer and lode deposits being utilized. But in

some places the Spaniards built large concentration mills, the ore being crushed by water power or by the treading of animals. The entire hill of Potosí was honeycombed with vein workings.

In spite of the vast mineral wealth obtained from the Andean recesses, this great industry benefited the local population little. The excellent highways and irrigation workings fell into decay. Although

FIG. 77. RIMAC VALLEY, ABOVE MATUCANA

The deep valleys and slopes of the Western Cordillera in the rain zone and below it, where water was available for irrigation, supported a rather dense Indian population when the Spaniards came. In this zone large areas, formerly cultivated, now lie idle.

wheat, oats, alfalfa, olives, and grapes, hitherto unknown, were introduced, little attention was given to agriculture, the chief source of subsistence for most of the people (Fig. 77). On the other hand, in addition to the minerals that went to Spain, quinine, chocolate, and potatoes constituted gifts of the new region to the old. However, from these Peru gained little. The main object of the Home Government was complete suppression of independent thought, action, and trade. The colonists were treated as children; the Inquisition brought with it religious intolerance and persecution; official and priest united in oppressing the original inhabitants of the land.

Independence and the Republic.—Along with the general revolt in other parts of the continent, the independence of Peru was achieved by the battle of Ayacucho, on December 9, 1824, with the decisive defeat of the last Spanish forces.

Although the mining of silver and gold, together with a little copper, continued to be one of the chief industries during the days of the republic, the mining industry suffered a decline, owing to the exhaustion of the more accessible lodes and the richer placer deposits, the unstable political conditions of the times, and the entrance of other items into the commercial life of the country. Worked for centuries by the Indians, the guano deposits began in the early days of the republic to assume an important rôle in Peruvian economy. Soon after 1826, the exportation of nitrate of soda from Tarapacá, then the southernmost province of Peru, began.

The Guano Industry.—The exploitation of the guano deposits began on a significant scale in 1840, owing to the increasing demand of northwestern Europe for fertilizers. For almost forty years the whole commercial and economic life of Peru revolved around this one source of wealth.

Special geographic conditions favored the development of this unique activity. The guano-bearing areas consist of a large number of desert islands off the coast of Peru, extending from Pisagua in 20° S. latitude to the Lobos Islands near 7° S., a distance of approximately 850 miles (Fig. 78). The principal islands include San Gallán, Ballestas, Chincha, Asia, Pescadores, Mazorca, Guañapi, Macabi, and the Lobos group. Conditions favoring the collection of the guano deposits include: the cold waters of the Humboldt Current, carrying a great variety of plankton of animal and plant life; upon this material feed enormous numbers of small fish, serving as food for myriads of birds, including the guanay [1]—a white-breasted cormorant, the piquero—a booby, the alcatraz—a grey pelican, and the camamay—a tropical gannet or booby; and the desert climate with no rain and much sunshine. This combination of geographical conditions is basic to the industry which put Peru in the first rank among the new republics of South America.

Between 1840 and 1870 this industry gave the country an unpar-

[1] The guanay (*Phalacrocorax bougainvillei*), the piquero (*Sula variegata*) and the alcatraz (*Pelecanus thogus*) are peculiar to the Humboldt Current.

alleled boom. Shipments of guano from 1862 to 1873 averaged 467,000 tons per year. The governmental income obtained through concessions for working the guano islands provided three-quarters of the

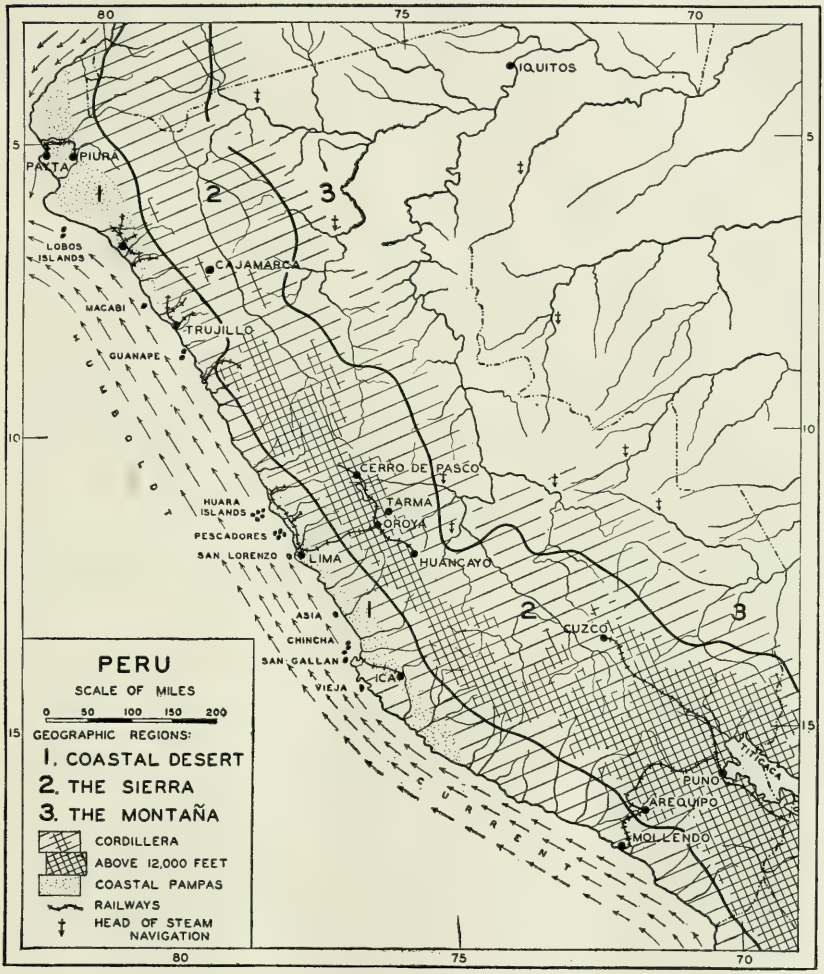

FIG. 78

national revenue, furnished capital for development of agricultural lands, and built highways and railroads that put Peru far ahead of other South American countries in this respect. The industry attracted world-wide attention. It brought to Peru large numbers of

immigrants as laborers on the guano islands; the oriental and negro elements of the coastal desert population were introduced at this time. They have left an indelible stamp on this part of the republic. During this era the export trade of Peru shot up to $27,000,000 in 1877, just before the great catastrophe in Peruvian economic life—the disastrous war with Chile (1879–1884). A few years before the war the guano industry reached its peak and started to decline, owing to the woeful destruction of bird life, the depletion of the richer guano deposits, and the beginning of competition in world markets with other fertilizers, which cut the price of fertilizers from $80 per ton to $50 per ton in a relatively short time.[2]

The Effects of the War of the Pacific.—The nitrate industry had its inception in 1825 by Chilean producers in the Peruvian province of Tarapacá and the Bolivian province of Antofagasta. Peru and Bolivia, unable to develop their nitrate fields and jealous of the activity of the Chileans in the region, agreed by secret compact, February 6, 1873, that if one became involved in trouble with Chile the other would assist. In 1878 Bolivia imposed an export tax on nitrates from the province of Antofagasta, which she had promised not to do. The result was the War of the Pacific (see pp. 117–18). In the struggle, Chile was speedily victorious on land and sea, and after a long occupation of the nitrate fields, the guano islands, and the principal cities and valleys of Peru, peace was established in December 1883.

The war practically crushed Peru. The republic lost forever its

[2] Following the collapse of the guano industry, at the time of the War of the Pacific, relatively small quantities of guano were extracted in a destructive fashion by several companies. After its organization in the early '90's, the Peruvian Corporation had complete control of the output until 1909. Since that time the guano resources have been under the control of the Compañía Administradora del Guano. This semi-official organization perpetuates, through its regulations, a valuable source of fertilizer for the Peruvian farmer. It has closed the islands to visits of unauthorized persons; it has watchmen on each island, who protect the birds from hunters or other bird enemies; it works according to a rotary system the deposits in forty different places. After an island is worked it is left for thirty months for guano accumulations. Diseases of birds are being studied. The company carries on an advertising campaign among Peruvian farmers to increase the consumption of guano. It leases the various islands to organizations which produce the guano, the price of which is fixed according to nitrogen content. The average price of guano delivered at a plantation ranges from $35 to $42 per ton. Production under control averages approximately 90,000 tons per year. In addition to this, the Peruvian Corporation still exports from 10,000 to 20,000 tons a year. When the Peruvian Corporation allotment of 2,000,000 tons, assigned to it in 1890 and 1907, is reached, the Compañía Administradora del Guano will have complete control of a permanent source of fertilizer of great value to the cotton and sugar producers of the Coastal Desert. ("Extracto Estadístico del Perú," 1927, Ministerio de Hacienda y Comercio, Lima, 1928.)

valuable nitrate deposits in Tarapacá; the provinces of Tacna and Arica, just north of Tarapacá, were occupied and held by Chile.[3] The workings on the guano islands had been obliterated. Most of the transportation facilities of the country had been destroyed along with some of the fertile agricultural lands. The country, left a bankrupt nation, had an annual governmental revenue of about $7,500,000 and a war debt of approximately $250,000,000. Foreign capital for development purposes did not move readily into Peru. In attempts to secure money with which to meet payments on the national debt and to reconstruct the disrupted industries of the republic through one concession or another, Peru lost control of her major resources. The resources covered by concessions included the guano deposits, some of the mineral regions of the Andean zone, the two great railways of the country and a few proposed lines, some of the more important ports to be used as free ports, and some of the fertile farming lands of the irrigated valleys. In 1890 an agreement was made with the bond-holders of the Peruvian debt, whereby the Peruvian Corporation was formed in London to take over important concessions in return for the cancellation of the debt to British creditors. Frequent revolutions, following the War of the Pacific, the financial entanglements just mentioned, and the disagreements between the Peruvian government and the directors of the Peruvian Corporation precluded marked development. Peru actually stood still until 1905.

[3] A provision was made for a plebiscite to be held ten years later in order to settle the ownership of the Tacna-Arica territory. Owing to difficulties of one kind or another the plebiscite was never held, Chile remaining in possession of the territory. In 1923 the question was submitted to the arbitration of the President of the United States, in respect to the holding of the plebiscite. The commission appointed to supervise the holding of the plebiscite in 1926 failed in its mission. After repeated efforts by officials of Chile, Peru and the United States Governments they finally reached, in 1929, the probable satisfactory disposition of this long-contested area. (1) The territory was divided into two parts: Tacna for Peru and Arica for Chile. The dividing line starts at a point designated with the name "Concordia," situated ten kilometers to the north of the bridge over the river Lluta, and continues parallel to the Arica-La Paz Railroad following as far as possible the topographic features making easy the demarcation of the line. (2) The Government of Chile gave to the Government of Peru, within the one thousand five hundred and seventy-five meters of the Bay of Arica, a wharf (Malecón), a customhouse and a station for the railroad from Tacna to Arica, where Peru enjoys independence within the most ample free port. All the aforementioned works shall be constructed by the Government of Chile. (3) The Government of Chile will deliver to the Government of Peru the sum of $6,000,000. (4) The children of Peruvian nationals born in Arica shall be considered as Peruvians until they attain the age of twenty-one years, at which age they shall have the right to elect their definite nationality; and the children of Chileans, born in Tacna, shall enjoy the same right.

MODERN PERU

Out of all the revolutions, entanglements, and difficulties, a new Peru has developed during the last quarter of a century. The foreign trade has grown from $12,000,000 in 1887 to more than $200,000,000, a sixteen-fold increase. New industries came forth and gradually established a firm economic foundation, upon which has been constructed the remarkable recent advance of the republic (Fig. 79).

FIG. 79. DUSTING SUGAR CANE

Sugar cane in the Coastal Desert has been a significant factor in the recent advance of Peru. (*Courtesy of Huff Daland Dusters.*)

The cultivation of sugar cane, which had assumed some importance in the seventies, again expanded with the investment of foreign capital in plantations. The growing of cotton was forwarded by the extension of simple irrigation works in a number of coastal valleys, and the crops became quite important, owing to the high prices paid in foreign markets for the Peruvian *rough* and *semi-rough* varieties (they brought almost twice as much as American cotton) and to the propagation of Egyptian varieties. The output and shipments of sugar and cotton rose steadily, placing these commodities among the leading exports of the country.

The old mineral exports, gold and silver, gave way to new ones. Valuable deposits of high-grade copper ore were discovered at Cerro de Pasco, where the silver deposits had been worked for centuries, and

copper soon began to play a significant part in the foreign trade; in 1910–1912 copper led with 24 per cent of the total value of exports. While petroleum did not share the early spectacular development of copper, its shipments added another export commodity, and in recent years has surpassed all other exports.

The steady development in all the preceding industries set the stage for the great expansion of the last fifteen years. This period was marked by an extension of foreign trade. All the major exports

FIG. 80. A SCENE AT THE WELL, COASTAL DESERT

The incorporation of the Indian and mestizo of Peru into the general scheme of development is one of the chief problems of the republic.

registered a favorable increase. In this expansion four items of export have been especially significant; four commodities constitute almost 90 per cent of the total exports (1927): petroleum, 32 per cent, cotton, 23 per cent, sugar, 16 per cent, and copper, 16 per cent. Thus, in a country known so long for its minerals, nearly half the exports consist of products of the farm. In addition, manufacturing establishments of considerable variety turn out increasing quantities of fabricated articles.

The opening of the Panama Canal removed in part the isolation from which Peru had been suffering. New irrigation works increased the fertile lands of the desert coast, port improvements aided shipping, railway and road extensions have opened up isolated com-

munities which have reposed for centuries in the quiet solitude of remote mountain valleys. Water and sewage systems and light plants in several centers have elevated somewhat the low standard of life. Thus, the buying power of many people has been raised. Many Peruvians feel the pulse of progress of the twentieth century.

But in spite of this remarkable advance Peru still faces major handicaps. Throughout the republic as a whole, transportation facilities are meagre. No railway net exists; only two lines pierce the Andean zone and none reaches the eastern lowlands. The country lacks a large middle class to span the wide gulf between the wealthy ruling class and the mass of Indians and mestizos (Fig. 80). Immigrants do not flock to Peruvian shores; there is little room for them in the coastal desert; they will not endure the hardships of life in the elevated Andean region; they are not attracted by the remote and highly isolated lowlands of the eastern part of the country hindered by the tropical heat, excessive rainfall, imperfect drainage, dense tropical forests, the prevalence of diseases, and only a sprinkling of uncivilized Indians and a few Spaniards and other nationalities in the isolated settlements.

Expansion of agricultural interests, oil enterprises, and manufacturing in the west, the continued development of the producing and dormant mineralized zones, and the opening up of the forests and lands of the east will emphasize still more in the economic, social, and political life of the country, its major geographic regions: The Coastal Desert, the Sierra, and the Montaña.

CHAPTER XIII

PERUVIAN COASTAL DESERT

Practically a rainless strip, the Coastal Desert extends from the north to the southern boundary and from the islands and bold Pacific headlands to the western flank of the Andes, at an altitude around 8,500 to 9,000 feet, where small but certain rains provide moisture for pasture and crops without irrigation. Nearly 1,400 miles long and not more than 80 miles wide at any point, the region embraces approximately 10 per cent of the country and supports about 30 per cent of the total population. Unclad and waste, except where many short streams from the mountains have provided irrigated oases, it consists of drifting dust and sands, bold headlands, and rugged mountain spurs separating narrow, level, fertile valleys. It possesses the chief modern means of transport of the republic, water, rail, and highway. It supports many ports and the flourishing towns and cities. It has, other than the primary fabrication of minerals and the home industries of the highlands, the manufacturing enterprises of the country. Most of the upper-class Peruvians and the foreigners dwell in the cities and on the *haciendas* of the region. The irrigated oases and the oil fields yield three of the leading exports of the republic; the watered valleys produce many subsistence products adapted in several respects to the desert environment.

PHYSICAL CHARACTERISTICS

Relief and Soils.—The coastal zone presents a variety of relief features and soils. In the north a low coastal plain, attaining a width of nearly 80 miles a little south of the port of Paita, diminishes until it disappears near Trujillo in 8° S. latitude. East of the plain tower high rugged mountains. From 8° S. latitude to 13° S. the rugged mountain spurs from the Andes end at the sea in bold headlands; they are separated by deep narrow alluvial plains and delta flats where infrequent streams enter the sea. Between 13° S. and 15° S. a desert plain extends inland from 20 to 40 miles. South of Pisco,

coast ranges rise abruptly from the sea, but are broken here and there by deep valleys that lead down from the high Andes. East of the coastal range the deeply stream-trenched plateau, 30 to 40 miles wide, extends as desert *pampas* to the foot of the Andes. Little level land exists in the whole Coastal Desert. Everywhere the surface slopes rather rapidly toward the sea.

A bold even coast line with few deep indentations and only two or three good harbors in 1,400 miles, is bordered here and there by barren small island groups, the source of Peru's great fertilizer, guano.

Fifty-two rivers cross the Coastal Desert. Only one rises beyond the Western Cordillera; many which have their sources high in the Andes

FIG. 81. PLOWING IN THE COASTAL DESERT

The sandy loam and clay soils in many valleys are well tilled with the big three-bottom plows drawn by drums beneath steam engines, one each at the ends of the fields.

flow throughout the year, although most of them become very low during the dry season; many not more than small creeks become raging torrents with infrequent heavy rains in the lower foothills. In the large valleys, which have been cut by snow-fed streams and later partly filled, deep alluvium covers the floors upon which the bordering cliffs abut with striking sharpness. Rather extensive flats provide easy cultivation.

The coastal valley soils, generally quite deep, possess excellent texture and good natural drainage, owing to the fact that most of them are superimposed on permeable strata of sand or gravel. In general, the soils are friable (Fig. 81).

The physical and chemical composition of the soils varies with the nature of the rocks over which the streams forming them have flowed, the slope of the rivers, and the formed land. The proportions of sand

and clay are variable in the different valleys and the cohesion and permeability of the soil vary also within wide limits. All classes of soils occur in the several valleys, from compact and humid ones of almost pure clay, through loams and sandy loams to almost pure sand. The more gravelly, stony, and least moisture-retaining soils lie in the upper parts of the valleys, while the more alkaline ones are in the lower sections, owing to less efficient natural drainage and to the accumulation of alkali salts. The thickness of the top soil is greatest in the lower parts of the valleys where it occasionally reaches several feet. The subsoils vary both in physical and chemical conditions; the stony, gravelly, and sandy subsoils show well-drained and porous top soils above them, whereas the more impermeable subsoils, particularly in the case of shallow top soils, show the more humid and poorer drained types superimposed upon them.[1] Heavily laden with fine sediment, irrigation waters add new soil materials to the fields with each application of water; strong, daily winds whip the fine surface materials of interstream areas into clouds of dust that leave a fine sediment on everything. Lack of leaching in the desert climate gives soils of high mineral content, but lacking in humus.

Climate.—Though well within the tropics, the temperatures of the Coastal Desert are not excessively hot. For much of the region temperatures range between 50° F and 100° F. Mean monthly temperatures for most desert stations average between 59° F and 77° F. There are two well-defined seasons: a cool one from June to November and a hot one during the remaining months. Temperatures may reach 100° F on hot summer days, but the dependable strong sea breeze, the most important meteorological feature of the Peruvian Coast, alleviates the heat; even in the middle of the hottest season the nights are seldom uncomfortable. As in most desert regions, temperatures vary greatly from day to night, the largest ranges taking place in the hotter months. The cool of the so-called winter season penetrates, especially in the immediate coastal strip, owing to the prevalence of fogs and mists, a prominent feature of the climate of the region.

Classed as one of the driest deserts of the world, the region is not without precipitation. Yet, the entire area gets less than 10 inches

[1] J. A. Lavalle y García, *Los Carácteres Agrológicos de las Tierras Cultivadas en la Costa del Peru, Lima*, 1918.

per year. Four strips are pronounced: (1) immediate coastal terraces and lower slopes, without rains; (2) the upper slopes of the coastal hills rather constantly enveloped in fog and mists, and receiving from 1 to 8 inches of rain per year in irregular infrequent showers; (3) the valleys, ridges, and *pampas*, a bright sunny area occupying much of the region and receiving rain only at intervals of many years, and (4) the zone of steep valleys on the inner margin of the desert, where small but yearly rains beget a verdant landscape in contrast to adjacent nude stretches to the west (Fig. 82).

The basic causes of the general aridity of the region include: the cold Humboldt Current, whose width ranges from 100 miles west of

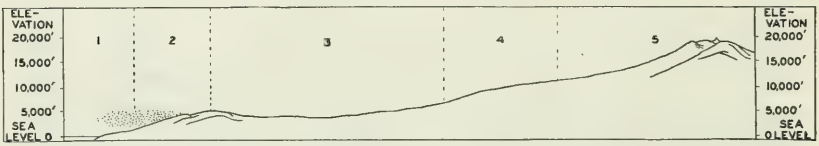

FIG. 82

A generalized diagram showing the relation of precipitation zones to relief in Coastal Peru. (1) The narrow zone of low coastal terraces where rain may come once in many years; (2) the zone of fog-covered coastal mountains, an area of sparse growth of grasses following rains at intervals of several years; (3) the arid desert zone between the coastal strip and the high Andes in which rain seldom, if ever, falls; (4) a zone of small but yearly rains, a region of deep valleys and steep slopes beginning around 8,500 feet and extending up the Andes; (5) the elevated mountain region with frequent precipitation in the summer months on exposed slopes; in this zone precipitation may amount to as much as 60–70 inches in a year. (*After Isaiah Bowman.*)

Callao to 200 miles west of Cape Blanco in 4° S. latitude and whose temperatures are 7° to 9° colder than adjacent waters; the upswelling of cold waters along the shore; the rather constant high temperatures of the parched desert stretches; the strong southerly winds from over the cold current paralleling the coast or moving on shore to warm lands and into warmer latitudes, consequently drying winds, except where adiabatically cooled by marked ascent on the face of mountains; descending, moisture-taking air from the Andean slopes; and the well-developed land and sea breezes.

Any significant seasonal change in these controlling phenomena may introduce striking variations. A weakening of the average 4-or-5-mile-per-hour velocity of the Humboldt Current or its slight shift to the west, allowing warmer waters from the north to slip between it

and the coast, may cause the heavens to open and deluge valley, field, and home with a flood of water and wreak havoc to crops, traffic lines, and desert-constructed huts.[2]

The remarkable development of the sea breeze, resulting from the great difference in land and sea temperatures combined with the prevailing wind, deeply affects human activities. For an hour or two before it commences in the middle of the forenoon, the desert air, hot, oppressive, and filled with dust, almost stifles trudging man and beast. Maximum temperatures are reached just before the sea breeze begins its tempering influence. By the boisterous noon breeze, laborers time their siesta rather than by higher temperatures of earlier hours. It may usher sailing vessels into port, or it may stop all transfer of cargo in the afternoon. It is a prime factor in holding the fog bank against the coastal mountains, in alleviating the oppressive heat of the hot summer day and in carrying moisture to the inner valleys of the Coastal Desert. It increases the slow drift of migratory sand belts of inter-stream areas.

Flora.—Consequent upon high temperatures, low precipitation and desiccation, vegetal growth is sparse and meagre. Treeless, except for the *algarrobas* of Piura and the inner valleys, and for exotic species in towns and irrigated lands, much of the area consists of sandy stretches devoid of plant life, even of cacti. A sparse growth of grasses and the *guishar*, a lowly desert tree, appears in the fog belt on the seaward slopes of the Coast Range and in the inner valleys around 7,000 to 8,000 feet. Avoiding the parched desert wastes plants, animals, and man tenaciously cling to the valleys with their refreshing and life-giving waters.

AGRICULTURE

Agriculture dominates coastal Peru. Most of the wealthy and influential families of the country spring from the *haciendas* of the irrigated valleys. Agriculture and related activities occupy the attention of a major share of the population. The irrigated strips totalling some 640,000 acres amount to only 16 per cent of the farm lands of the country, but they yield nearly half the agricultural produce of the nation. They furnish the chief raw materials for the

[2] Murphy, R. C., "Oceanic and Climatic Phenomena Along the West Coast of South America During 1925," *Geog. Review*, Vol. XVI (1926), pp. 26–54.

FIG. 83

The many narrow irrigated valleys of Peru set this desert strip off in striking contrast to that of North Chile. The dotted line is the lower limit of the rain zone.

factories of the region and provide nearly half the total exports of the republic. Except for mere patches they consist of artificially watered lands.

Irrigation.—Irrigation has become traditional with the coastal farmer. Upon the life-giving waters of the fifty-two short streams that descend from the Andes the farmer completely depends. Without the waters plants wither and thirsty animals, with hanging head and extended tongue, pant in the heat of the day. With each new application of water all crops take on a new aspect and animals quench their thirst and cool their feet in flooded meadows or irrigation ditches. The irrigated valleys extend along the whole coast, but are more numerous and larger north of latitude 14° S. owing to the greater supply of water from the rainy Andes of the northern portion (Fig. 83).

Many small waste-filled valleys and alluvial fans favor easy distribution of water from the streams as they issue from the deep mountain valleys. A heritage of former days, irrigation systems, for the most part, are crude and simple. Facilities consist of gravity canals of dirt, usually lined with trees and other vegetation. Each plantation or field in the highest part has the mother ditch (*acequia madre*) from which radiate the secondary canals carrying the water to the various small fields, called *cuarteles*, and thence down the rows or middles. The excess water from the furrows collects at the lower end for re-use in fields at a lower level. Remarkable efficiency in laying out irrigation ditches, and in directing the flow of water makes possible the irrigation of large areas of land with few *peons*. In recent years large projects have been constructed in

the northern desert, one in which the water has been diverted from the headwaters of the Marañon east of the Western Cordillera.

The quantity of water applied to fields varies with the location of the valley, type of soil, time of year, age of fields, and crops. Applications of water are most frequent during the summer, corresponding to the period of flood waters in the streams, of great evaporation, and rapid growth of crops. It is almost impossible to calculate the amount of water used per acre or per crop as few *haciendas* have any actual measuring device or weir.

The amount of cultivated land is limited only by the quantity of irrigation water available. Two exceptions include the Santa and Tambo valleys where some water generally flows into the sea the year round. Fortunately, abundant water and high temperatures coincide inducing a rapid development of plants during the flood season. Much water of the Andean reservoir goes to waste; during the flood season millions of cubic feet flow unutilized to the Pacific. The waters of the flood season, if properly stored by means of dams and reservoirs, would reclaim vast areas. However, a 35 to 40 per cent increase in the crop land, according to the best estimates, is the greatest that can be expected.

While these arid desert lands are capable of yielding large crops, merely applying water does not turn them into productive lands of high quality. Some areas contain alkali, many lack organic matter, while others vary so in texture that often the light top soil washes away with the first application of water.

On account of the lay of the land, drainage is not a serious problem in general except on the lower, heavier lands where in some exceptional cases tile drainage gives fine results, as at the plantation—Esquival—of the Solar brothers. This estate, of more than 7,000 acres, has 5,000 in cotton; all of this except 600 acres has been reclaimed from lagoons, largely by tile drainage. Lands formerly containing alkali have been sweetened by drainage and now produce 1½ bales of *Tangüis* cotton per acre.

Land Tenure and Labor.—Following the Spanish conquest of Peru extensive land grants were made and many of the large *haciendas* of the coastal desert originating in the sixteenth and seventeenth centuries are still held intact by rich Peruvians. Plantations vary from a few hundred acres to seven thousand or more. Large areas in many ways favor irrigation agriculture. The passing of old families of estate holders,

the selling of legacies, and the leasing of their properties by widows of *hacendados,* gradually centralizes the management of contiguous areas. Ordinarily the breaking up of huge estates would be considered in most countries a healthy economic situation, but conditions are such in Peru that the opposite process seems likely to continue for some time to come, although the advantages of this system in the long run are doubtful.

Laborers usually live on the estates and are given a piece of land of their own to cultivate in addition to rations and regular wages of 58 to 75 cents for the days they work for the owners. The deficient labor supply on the coast makes it necessary for the planters to contract for Indians from the mountains during the busy season. These Indians usually are good workmen; while labor agitators have at times caused considerable trouble for both them and the plantation owners, most strikes and riots result from dissatisfaction arising from faulty management on the part of the plantation administrators.

The living conditions are far from satisfactory, but employers who seek to improve the conditions get scant cooperation from the ignorant laborers accustomed to this plane of living.

Small adobe houses are furnished the laborers. Only the better ones have tile or concrete floors. On many of the larger estates they stand in long rows, frequently around a hollow square. Each family has one large room and a sort of kitchen or in some cases two rooms and a kitchen arrangement. As it seldom rains, the roofs are usually of adobe, mixed with stable manure and straw as a binder; a very little rain plays havoc with the interior. The government now provides that all adobe houses must be made ratproof by being built of concrete to a certain distance above the ground, in order to combat the frequent outbreaks of bubonic plague, epidemic in many parts of Peru.

Cultivation varies from the crude methods of past times on small mixed holdings to modern on some of the big estates. On the larger estates, after the land is thoroughly cleaned, it is plowed with the Fowler stationary steam engines, which pull the plows along by means of a cable rolled on a drum underneath the locomotive. These engines may be placed as far apart as 600 yards and do remarkably efficient work.

Three deep plowings, with stationary engines, tractors, or bull plows, followed by harrows and a cross harrowing, leave fields in an

excellent condition for planting. Where the land is too hard and dry for the best work, the application of the proper quantity of water puts it in a good condition for working. On the whole, after crops are planted little machinery is used owing to the number of irrigation and drainage ditches and to the general ignorance of the farm laborer. A generous application of guano, received by the farmers at a price based on chemical analysis of the product through regulation of the *Compañía Administradora del Guano,* to most fields gives good results. In recent years much has been done to combat the ravages of insect pests and diseases for the chief crops.

Crops.—Rich in a variety of commodities, the irrigated valleys yield two great commercial crops, cotton and sugar, and a host of subsistence products, including corn, rice, wheat, barley, alfalfa, many vegetables, and numerous tropical and subtropical fruits. With the recent agricultural expansion, as much land as possible has been planted to sugar and cotton, creating in some districts an actual shortage in some foodstuffs.

Cotton.—Cotton, indigenous to Peru, has made striking progress as a commercial crop during the last 25 years. With a production well under 40,000 bales in 1900, the output at present exceeds 180,000 bales. It constitutes in value a quarter of all exports, and has become one of the most dependable sources of wealth.

Cotton, more widely distributed than sugar as it requires less capital, finds a place on big sugar estates as well as on many small holdings, growing cotton exclusively. Thirty-five valleys are engaged in the production of the commercial crop, but the bulk of it grows in ten small valleys. Three fairly well-defined districts—the Piura and Chira River Valleys in the department of Piura, the central coast region from Chimbote to Ica, and the southern region—account for about 130,000 bales or 75 per cent of the total output (Fig. 84).

Climate in most of the coastal belt favors a large yield of good-quality cotton. No hail bruises the growing boll, no rain discolors the ripening fiber, and no frosts injure the development of the plant. Uniformly high temperatures throughout the year and the proper application of water to the heavily fertilized soil afford optimum conditions. Also, while the region is not free from pests and diseases, the dry atmosphere hinders development.

As a result of favorable conditions Peru, even with only fair methods

of cultivation and poor machinery, produces high yields of cotton of good grade. The yield of cotton averages more than that of the

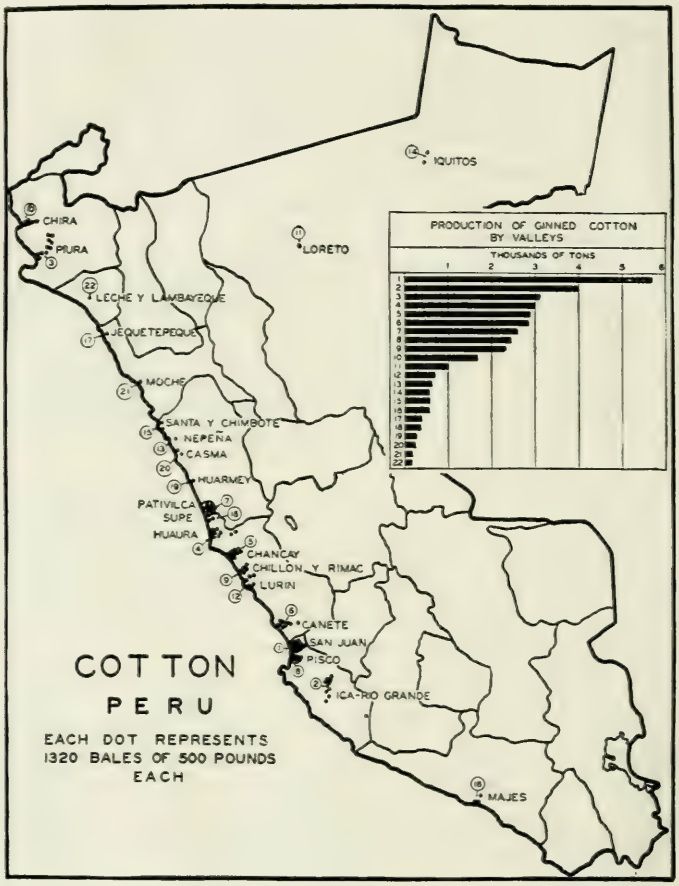

FIG. 84

Practically the entire cotton crop of Peru comes from three distinct districts—from Chira to Piura in the north, from Chimbote to Lurín in the center, and from Cañete to Ica in the south—in the irrigated coastal valleys. (Statistics, four-year average, 1916–1917 to 1922–1923; *Statistical Abstract of Peru*, 1919, 1920, 1923, 1924, Department of the Treasury and Commerce, Lima; *Estadística de la Producción en el Peru 1920 y 1921*, Ministerio de Fomento, Lima, 1924; *Foreign Crops and Markets*, March 22, 1926, Department of Agriculture, Washington.)

United States, and ranks well with that of the other leading cotton countries of the world. On good land it amounts to one and one-half bales per acre.

Since two or three crops can be obtained from one planting, and in some places five with a generous use of fertilizer, a general renewal of the fields does not occur each year; planting coincides with the available water supply. The picking season is neither sharply defined nor uniform. While the peak of the harvest extends from April to July, picking takes place in one valley or another throughout the year, affording a rather uniform movement of cotton.

Several varieties, each of which has a number of grades, enjoy a considerable demand in the markets. The "Peruvian full rough"

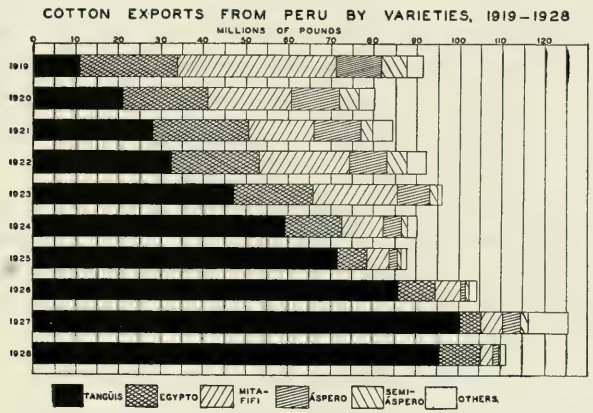

FIG. 85

The permanent position which cotton holds in the irrigated Coastal Desert of Peru depends almost entirely upon the increase in the output of *Tangüis* cotton; since 1919 the continued high export movement of cotton from Peru has resulted primarily from the phenomenal rise in the shipments of *Tangüis*, as all other varieties have registered a striking decline.

(*áspero*), with a long and very rough, crinkly fiber, mixes well with wool in textiles. *Mitafifi*, a variety with a long, cream-colored, silky fiber, is especially suitable for the manufacture of automobile tires. *Tangüis* has a very white and long fiber in both rough and smooth grades, and gives yields from 25 to 30 per cent greater than any other variety; it constitutes about 75 per cent of the total Peruvian crop (Fig. 85).

Cotton is primarily an export crop, approximately 90 per cent of the production entering foreign markets. Although the exports have registered a remarkable growth in recent years, the increase during the next few years probably will be relatively small. An increase in

the output depends upon a greater acreage with more irrigation facilities, better means of combating the Peruvian square weevil, the cotton stainer, the cotton worm, and the white scale, and an extension of wilt-resistant *Tangüis* cotton.

Sugar.—Sugar has risen during the past 40 years from almost insignificance to one of the leading money crops of Peru. It constitutes nearly a quarter of the total exports of the country, supplies local consumption, and furnishes about 60 per cent of the alcohol made in the country. It gives steady employment on a large scale to the uneducated laborers attached to each extensive *hacienda*, offers many responsible positions to the educated class, creates a demand for foreign agricultural implements, milling machinery, and railway equipment. In fact the prosperity of the sugar industry determines the buying power of a considerable part of the coastal desert population.

Physical factors favor cane culture. Friable alluvial sandy loam soils to which is added 150 to 200 pounds of guano per acre annually, a proper application of water, the large number of sunny days, and continuously high temperatures afford optimum conditions for a uniformly large yield of cane of good quality.

In general, the yield of cane in Peru ranges from 40 to 60 metric tons per acre. In contrast Cuban yields of cane average only 20. It should be remembered, however, that the crop in Cuba is annual, whereas in Peru cane requires from eighteen to twenty-two months to reach maturity.

Production of sugar cane on a commercial scale is confined almost entirely to 15 valleys, although a number of others produce minor amounts (Fig. 86). Three departments—Libertad, Lima, and Lambayeque—furnish 92 per cent of the total output. The Trujillo district in Libertad occupies the premier position. Here the sugar industry overshadows all other activities; the Chicama, Moche, and Viru Valleys are entirely given over to it. This district alone produces about one-half of the total crop of Peru. The plantation system of cultivation prevails; the producers have attained a high degree of scientific cultivation and mechanical proficiency comparable with methods in the leading sugar countries of the world.

The absence of rain, the abundance of sunshine, and the uniformly high temperatures make it possible to plant cane during practically

every month of the year, although the larger areas are laid out during the flood season from November to April. Three cuttings are usually obtained from one planting, but seven or eight cuttings are common on the better lands. Therefore only portions of the fields are planted from year to year. Moreover, cane may be cut and ground the year round, thus avoiding a rushed harvest season as in other regions and

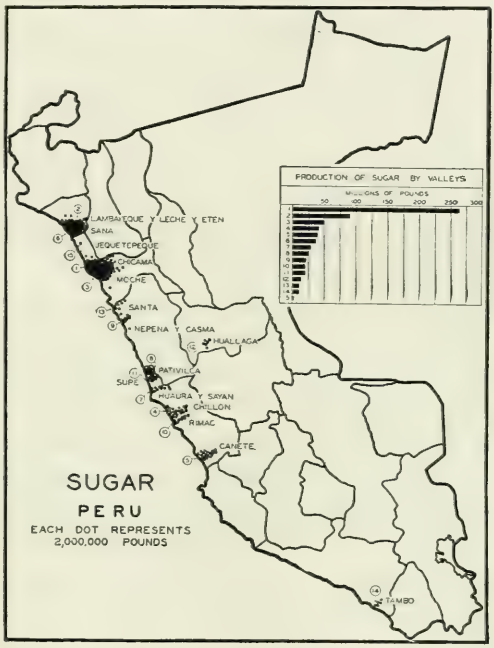

FIG. 86

Grown in most of the irrigated valleys, sugar production in three districts prominently stands out. These supply more than 90 per cent of the total. (Statistics four-year average, 1918, 1919, 1922, 1924; *Statistical Abstract of Peru*, 1919, 1920, 1923, 1924. Department of Treasury and Commerce, Lima.)

supplying a fairly steady flow of sugar for the export movement throughout the year.

The large estates, some containing 30,000 acres, have made possible the introduction of modern methods and expensive machinery and equipment, factors which play an important part in the commercial production of the crop, for they influence vitally the quality of the finished product and reduce materially the waste of old grinding methods.

In addition, the cane districts of Peru are favored by cheap labor, for the average cost of labor on the sugar estates amounts to only half the average wages paid in Hawaii or Cuba. Of all the major cane-growing countries, only Java has a lower wage than Peru.

It is impossible to maintain the rate of increase established between 1910 and 1920 in the production and exportation of sugar. In the valleys actually producing cane, practically all the land for which water exists for irrigation is already under cultivation. But with the introduction of tractors and other machines, which will release for sugar cultivation lands now in pastures and crops for the animals used on the estates, with a more efficient utilization of water, with the introduction of better machinery that will extract a larger percentage of sucrose, and with the opening up of desert lands by the several new irrigation works now under construction, a considerable expansion in the industry may take place.

Subsistence Crops.—Rice cultivation has developed steadily for the past decade. Many of the *haciendas* grow it, but the bulk of the crop is produced by Asiatics and the small farmers of the Indian or mestizo class. The ease with which rice can be threshed, cleaned, and prepared for food appeals to the native who has little or no scientific knowledge of agriculture. Easily prepared and combined with nitrogenous beans or other legumes, it makes a satisfying and nourishing meal. Rice, planted any time during the season of abundant water, from November to March, is produced with one flooding and little plowing. Two crops are usually harvested during the season from May to August. The average yield of about 1,800 pounds per acre equals or excels the output per acre of the United States. Public mills are available for the small planter, while most of the large *haciendas* possess their own.

Production of rice is confined largely to the coastal valleys of Lambayeque and Libertad. These two departments supply about 48,000 metric tons or 75 per cent of the total. Considerable quantities are also raised in the coastal valleys to the south. To replace the exports and to supply the excess demands over production, rice must be imported from the Orient, United States, and Brazil.

In the irrigated valleys of the coast, corn planted practically any time that water is available matures in three or four months. Two or three crops may easily be grown in one year, which accounts for so

much being raised in the Coastal Desert. Besides furnishing the natives with a considerable part of their food supply, large quantities of the crop are used for making *chicha*, the most common beverage of the lower classes. It also supplies much forage for the *hacienda* animals.

A variety of legumes are grown in the Coastal Desert, but beans are the most important. Produced over a wide area and grown under a variety of names, they constitute an important part of the food of the people. The many different varieties of field beans, black, brown, and others, are generally known by particular names in trade. Broad or horse beans, which thrive in all parts of the country, are the chief variety produced. Grown only for local needs, they are chiefly an inter-tilled crop, thus needing little cultivation. They can be harvested easily, possess good keeping qualities, and like rice require little effort in their preparation for eating. They can be planted almost any time in the irrigated fields; and two or three crops may be gathered annually. Peas grow extensively in certain sections, as do lentils, lima beans, chick peas, peanuts, and many garden vegetables.

Miscellaneous Crops.—Tobacco, wheat, barley, and alfalfa find a place in the agricultural economy of many of the coastal valleys.

The cultivation of tobacco, subject to the control of the Tobacco Monopoly (*Estanco del Tabaco*), is grown in zones established by the monopoly; all the crop must be sold to this monopoly. For this reason and because of the great variations in quality and grades of Peruvian tobacco, owing to the more or less primitive methods employed, there has been little or no attempt to encourage its cultivation. In fact many sections which formerly produced considerable quantities have practically abandoned the industry.

Wheat has been replaced by rice in the Coastal Desert; barley, chiefly a highland crop, grows in a few places for forage. Alfalfa, growing much better than barley in many of the irrigated valleys, is widely used for animal feed. With a larger use of alfalfa in rotation and as range land for animals the *haciendas* could profit materially.

With large amounts of sunshine, continuously high temperatures, there are no better fruit lands anywhere than the irrigated valleys of the Coastal Desert of Peru. Bananas, oranges, lemons, and limes grow side by side with peaches and pears, delicious cherries, plums, dates, and figs. There are olives, grapes, watermelons, and musk-

melons, *guavas*, also papayas, chirimoyas, nísperos, and alligator pears (Fig. 87).

The vine and the olive have received greatest attention, yet are only of local importance. The chief grape sections include the Ica, Pisco, Chincha, and Moquegua Valleys, centers famous in colonial days for grapes and wines. Limes and lemons, while widely distributed, are usually of inferior quality; the bananas are small and in many cases insipid. Fruit can be found for sale at very reasonable prices in almost every town and railway station along the coast. However, before the fruit industry can be developed for the ex-

FIG. 87. A RAILWAY-SIDE MARKET, RIMAC VALLEY

port market, there must be improvement in transportation facilities.

Animals.—Devoid of natural range land and lacking large areas of pastures in the valleys the Coastal Desert supports a minor portion of the animals of the country.

Cattle lead in numbers. Tall, rough, and bony, they furnish the chief power for heavy work on many *haciendas* and provide a meat supply for all the region and some surplus for shipment to the nitrate fields of Chile. In the neighborhood of cities restricted dairy enterprises have sprung up. Most of the cattle of native breed dress into a low-grade meat; little effort has been made to improve the stock, the old breeds being quite well adapted for their chief use. High temperatures, pestiferous flies, abundant ticks, poor forage, and ignorance of the laboring classes hinder the animal industry. While

the large *haciendas* are supplied with some alfalfa and other artificial range land for animals, withering crops in times of frequent water shortage get the first application of the precious liquid.

Asses, mules, horses, swine, and goats find a small place in the economy of the *haciendas* of most valleys, though they do not total large numbers. Asses, mules, and horses are raised for transportation purposes on the estates and to the coastal ports. A few valleys rear them for exports to highland mining districts. Swine, a general scavenger, yield a local supply of meat. Goats, capable of picking a precarious living from the desert edges where other animals would perish, are reared everywhere, but especially in the fog- and mist-covered area of the Coastal Range and in the *algarroba* regions of the north, where the fleshy pods of the tree provide abundant feed. They supply chiefly skins, and meat, although in some districts the milk is used.

MINERAL DEVELOPMENT

The lower flanks of the Andes may have some mineral deposits of considerable import, but the Coastal Desert as a whole, unlike the adjacent rich area of Chile, yields little in the way of minerals except for petroleum. Petroleum products of this barren area have had a profound influence in recent years on the economic life of coastal Peru as well as on all the country. Petroleum production in Peru mounted from a few thousand barrels in 1900 to 10,000,000 barrels in 1928. Seventy-five per cent of the output enters foreign trade. Petroleum ranks first in the exports of the country with nearly one-third of the total (1927) having surpassed gold and silver, leading products for centuries, and copper, which first replaced gold and silver. It also furnishes nearly all the kerosene used in the republic and the fuel oil of the railways and factories of the Coastal Desert.

The total output of petroleum comes from six fields in the coastal region of northwestern Peru. The quantity of the oil varies from good to fair; most of it has a mixed asphalt and paraffin base and yields from 20 to 35 per cent of gasoline, from 16 to 36 per cent of kerosene, from 20 to 30 per cent of naphtha, a small amount of lubricating oils, and large amounts of fuel oil. The crude petroleum and fuel oil assume special significance owing to the general lack of other mineral fuels and water-power developments in western South America. Along the west coast they are being used in larger and larger quan-

tities in locomotives, coastwise vessels, expanding factories, and the huge nitrate plants of Chile. In respect to quantity crude petroleum and fuel oil constitute approximately 70 per cent of the total exports of petroleum products.

The part which these products may play in the development of the country during the next few years is difficult to forecast, for oil fields in general are known for their erratic production. As yet the potential fields in Peru are not fully prospected, and most of them are young, so that the output probably will increase rather rapidly for some years to come.

The future of oil in Peru, however, does not depend entirely upon the developments in the coastal regions, for possibly the richest of all oil areas in the country lies in the practically unexplored region of Peru east of the Andes. Here, superficial manifestations in many places and the fact that oil appears on the surface of several rivers lead one to believe that the region may have rich oil pools.

MANUFACTURING

Although the economic structure of the nation rests upon agricultural and extractive industries, the country possesses some manufacturing industries of considerable scope. While the republic exports raw materials and foodstuffs—chiefly petroleum, cotton, copper, sugar, wool, crude rubber, hides, and skins—and imports chiefly fabricated materials, its factories make many articles for home consumption.

Five hundred thirty some manufacturing establishments annually turn out wares valued at nearly $100,000,000.[3] Excepting the great Andean smelters and three of the five woolen mills, most of the manu-

[3] MANUFACTURING INDUSTRIES OF PERU

Kind of Industry	*Number of Establishments*	*Annual Production*	*Kind of Power Used*	*Total Horse-Power*	*Number of Laborers Employed*
Smelters	2	$34,400,000	Electricity	16,500	11,000
Petroleum refineries	2	24,000,000	Gas Engines and electricity	500	1,500
Food preparation plants	148	6,160,000	Electricity, gas engines and petroleum	1,750	
Flour mills	12 (a)	5,600,000	Petroleum engines and electricity	1,500	450

facturing plants of Peru are in the Coastal Desert. They are concentrated in four districts: the lower Rimac Valley, Arequipa region, Ica-Pisco Valleys, and the Talara section. The lower Rimac Valley has more than half the large plants of the country, owing to an early start, middle location, political and financial center of the country, the chief concentration of population and semi-skilled labor, and its direct contacts with the Sierra.

Except for the primary preparation of minerals, the fabrication of the products of the farm and pasture constitute the chief industries. The leading branches of industry include textiles—cotton and woolen—sugar refineries, flour mills, breweries, soap factories, cigarette establishments, and tanneries. Most of the wares consist of medium to low grade, but some of the new and larger plants turn out products that compare favorably with similar commodities made in Europe or the United States. While the Coastal Desert lacks the basic minerals for a complex industrial development, the Sierra holds in varying amounts almost the entire alphabet of minerals from antimony to vanadium. In addition to copper, vanadium and others, small deposits of iron and considerable coal lie dormant in isolated recesses. But when they are opened up, they will contribute to manufacturing

Kind of Industry	*Number of Establishments*	*Annual Production*	*Kind of Power Used*	*Total Horse-Power*	*Number of Laborers Employed*
Cotton mills	10	$5,200,000	Gas engines and electricity	4,550	3,000 (b)
Cigarette factories	1	4,800,000	Electricity	200	
Breweries	119	4,400,000	(c)	(c)	
Soap factories	60	2,800,000	(c)	(c)	
Match factories	1	2,000,000	Crude petroleum	120	
Tanneries	35	1,800,000	(c)	(c)	
Woolen mills	5	1,200,000	Gas engines and electricity	700	
Clothing factories	15	1,160,000	(c)	(c)	
Miscellaneous	21	1,900,000	(c)	(c)	
Others for which statistics are not available	102				
TOTAL	533	$95,420,000			

a. Many primitive mills not counted.
b. This figure includes woolen mills.
c. Not available.

establishments chiefly in coastal Peru or in foreign countries. Lacking water power resources, the Coastal Desert must turn with increased industrial activities to the Andean region for much of its electricity.

Several conditions in Peru restrict manufacturing industries. Though an abundance of cheap labor is available, more than 80 per cent of the labor in present establishments consists of unskilled or semi-skilled employees. Technically skilled persons must continue

FIG. 88. AN IRRIGATED VALLEY

Vegetables, corn and cotton in the foreground; line of trees and houses along the master irrigation ditch and the bare brown mountains beyond; most of the land of the region consists of the type shown in the distance; land that cannot become productive.

to come from the outside for some time. Little Peruvian capital enters manufacturing enterprises. Meagre and primitive transport facilities do not reach even the small domestic market, restricted materially by the low purchasing power of the major part of the population. The region is well supplied with raw materials in only a few lines—sugar, cotton, wool, hides, and a few others.

On the other hand several factors favor industrialization within certain limits. Developing transport facilities, both rail and highway, in the near future may tap isolated mineral deposits and penetrate undeveloped markets. An abundance of petroleum, much coal, and unharnessed water falls can contribute power for old and new plants and for transport. No discrimination against foreign capital and men,

relatively low taxes on new enterprises, and the introduction of a protective tariff, for the first time in 1928, all foster manufacturing establishments.

THE OUTLOOK

Economic expansion in the Coastal Desert faces definite limits. With a regulated water supply and a constant supply of rich guano the yields of the desert oases may be increased materially. Small dams even on little streams to impound the flood waters of the rainy season and the huge irrigation works now under construction will bring marginal strips into productivity and turn drifting sands and *algarroba* lands into verdant fields. Nevertheless, the irrigated area can be increased not more than 40 per cent (Fig. 88). On the other hand, modern machinery, improved irrigation systems, better methods of cultivation, effective means to combat insect pests and diseases, the general improvement of the living conditions of the agrarian class, and a more intensive utilization of the animal possibilities will augment considerably the output of the agricultural strips of the Coastal Desert.

The flood of petroleum of the northern desert enlivens old and new lines of activity not only in the Coastal Desert but in all Peru; yet the oil pools are exhaustible. Raw materials go to waste or lie dormant for want of fabricators and markets. Water power and coal in the Andes wait for man and capital to tap these material sources of energy. Many people with small outlook and less education advance slowly under the pressure of modern influences. Nevertheless, with all its nude and worthless land and other impediments to economic advance the Coastal Desert will continue the dominant geographic region of Peru.

CHAPTER XIV

THE SIERRA

Highland Peru has two-thirds of the people of the country, yet these 3,500,000 and the region which they inhabit account for scarcely one-fourth of the national export movement. Indeed, should copper be subtracted from the list of commodities, the fraction would drop to considerably less than one-tenth of the total. This is a land decidedly in contrast to the productive irrigated zone bordering it on the west and to the naturally rich, though economically insignificant, forest—the Montaña—on the east.

Not many years ago, the region stood head and shoulders above all the rest of South America. Here lay the objectives of the ruthless Spanish *conquistador*. Today, however, the Sierra furnishes an instructive story of the decadence of a once outstanding civilization. Its masses of stolidly toiling Indians and mestizos show little sign of the proud heritage which might have been theirs, little sign of the progressiveness which their illustrious forebears displayed. An illiterate backward group, they constitute a real problem for the Peru of the future.

Though the Sierra is the largest portion of the Andean Mountains and Plateaus embraced in any one country of South America, like other parts of the broader region it has a relatively high density of population. Again, as in those other parts, the concentration has resulted chiefly from the attractiveness of the highland in tropical latitudes. Secondary contributing factors are the protection afforded by difficulty of access and the long period of occupation. Configuration and elevation of the land make the distribution of this population highly irregular. More than one-third of the region has between 10 and 30 persons to the square mile, but a larger area has far less than 10 persons per square mile.

Urban developments of importance are few and far between; there is no voluminous flow of varied produce to cause the establishment of great centers for capital and commercial facilities. Arequipa, the

largest town of the region, and the second city of Peru, has 55,000. It is the entrepôt for all southern Peru and serves a large part of northern Bolivia. It owes much of its importance to its rôle as a wool market. Cuzco, a few centuries ago the capital of the vast Inca domain, ranks next to Arequipa and has 35,000 people. Situated at a place facilitating exchange of the products from the high cool plateaus and those from the rich temperate valleys of its vicinity, Cuzco has considerable commercial significance. No other center of the Sierra has more than 25,000 people. These smaller points have grown up because of position with reference to trade routes, agricultural districts, or mines.

A major obstacle to the growth of cities, spread of literacy, or improvement of conditions for the region as a whole results from the tremendous difficulties of transportation between the highland and the Coastal Desert. Even moderately favorable physical conditions exist in only one portion, where the Andes in Cajamarca descend to the easiest pass—below an elevation of 5,000 feet—between western Venezuela and southern Chile; but the region's most productive lands lie far to the south, where the completion of a route requires the utmost in engineering skill. Only two railroad systems—the Central and the Southern—extend from the coast into the elevated Andean region. No longitudinal line links these two. The Central on the way to Oroya serves the highest railway station in the world—Ticlio at 15,610 feet above sea level. The railway climbs to an elevation of 15,680 feet within 106 miles of the sea. It passes through 65 tunnels, has 67 bridges, and 16 switchbacks in this distance. As for even fair motor roads, they are practically nonexistent. For many years, the pack train of mules and llamas will continue as the customary form of transportation for most of the region. Rivers afford little navigation, but on Lake Titicaca there is a brisk movement of reed boats, *balsas*, and steamships which engage in domestic and international trade (Fig. 89).

PHYSICAL CHARACTER

Elevation accounts for most of the conspicuous characteristics of the Sierra. The region consists essentially of a great mass of mountain, plateau, and occasional deep valley, the bulk of the land exceeding an elevation of 5,000 feet. Thousands of square miles lie above

15,000 feet, the peaks lifting their rugged shoulders far into the zone of eternal snow. On the west the stupendous Cordillera Occidental culminates in the peak of Mount Huascarán at an elevation of some 22,000 feet, while to the east the Cordillera Oriental rises to more than 21,000 feet. It is from the great western range that most of Peruvian mineral wealth has come. The various ramifications of the two major ranges make the inter-range lands a confusion of mountain and plateau inclosing numerous basins wherein have developed most of the towns of the Sierra. Large areas have a surface of gentle relief, highly favorable to agriculture; the principal section of this type—at an

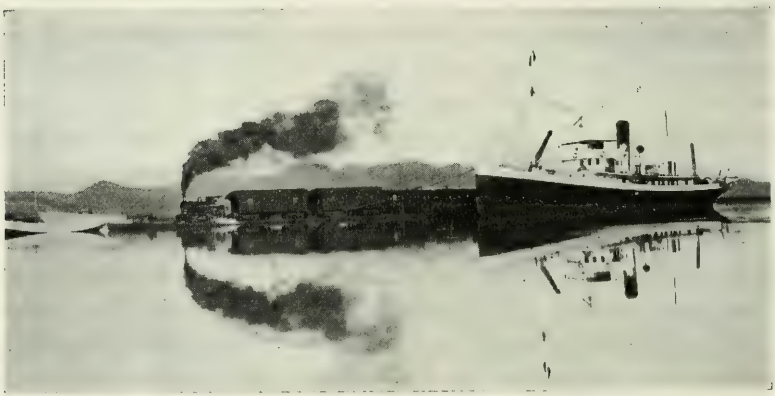

Fig. 89. Steam and Rail Transportation, Lake Titicaca

elevation over 10,000 feet—lies about Lake Titicaca. Between the longitudinal ranges, especially in the northeastern portion, the rivers have cut deep valleys, in which the farmers of the Sierra produce sugar cane, rice, and locally even cacao. The most notable of these strips of smiling farmlands is that of the Marañon River in the province of Cajamarca.

In a region with such contrasts of elevation, climate necessarily varies broadly among the various sections. The deep river trenches descend to truly tropical climates, while gaunt peaks a few miles distant rise above the snow-line. Annual precipitation displays striking variability, both from station to station and from year to year. Totals range from 10 to 50 inches; Puno at 12,500 feet receives 38.9 inches in a season from October to March; Cuzco, 10,920 feet, 34.7 inches; Huancayo, 10,850 feet, 31.6 inches; Cerro de Pasco, 14,160 feet, 35

inches; Cajamarca, 8,345 feet, 45 inches. During the rainy season, contrary to the rainy period on the coast, the rains commonly come in the afternoon and evening. During the dry season almost no rain falls, the sky being cloudless for weeks at a time. In many of the agricultural districts irrigation must be resorted to for its dependability. Most of the precipitation falls during the warmest part of

FIG. 90. NATIVE HUTS, OROYA, PERU

Cold, damp, straw-thatched huts, infertile stony hillside soils, no fuel for heating, food poorly cooked over an open fire in a stone enclosure—all indicate the miserable life of the highland Indian.

the year, the chief season for farm operations. Temperatures for most of the region exhibit typical plateau features, little range occurring in the comparatively low and uniform monthly temperatures. At an elevation of 12,500 feet, Puno records a mean monthly temperature of 43.5° F in July, and in its warmest month—November—has a corresponding temperature of 51° F; the mean annual being 47.5° F. Daytime temperatures are fairly high under the bright sun of the region's latitude and altitude above sea level; but at night because of the rapidity of radiation the air quickly becomes

uncomfortably chilly, so that heavy clothing is the rule throughout the year.

The character of vegetation and indirectly of utilization of land bears intimate relationship to elevation. Though in the warmer, more humid portions of the northern and eastern valleys occurs a rich mountain forest—the *ceja de montaña*—the Sierra more typically is a region of scanty vegetation. Grasses and low bushes are the common forms. The principal crop-producing districts lie in a belt of bushy growths, while the major grazing zone occupies the lands supporting various bunch grasses—such as the *ichu*—and numerous low shrubs. The inhabitant makes every possible use of the natural vegetation. The *ichu* grass affords fuel and thatch-material as well as forage for the animals (Fig. 90). Similarly the *tola* bush, a form found in moist places, is a valuable fuel-stuff because of its resinous content. A third important fuel, in this region without trees and having meagre resources in coal, is the *llareta,* a woody moss growing over bare rocks.

SIERRA INDUSTRIES

For the region as a whole, the agricultural industries are the most important. With a relatively large population, limited arable land and irrigating water, a close utilization of resources for tillage and pastoral pursuits has developed. Commercially, wool prevails as the principal agricultural commodity, but its importance as an export falls far short of that held by the region's mineral output. To the world at large the Peruvian mountains and plateaus signify a land of huge mineral resources rather than one of agriculture.

Agriculture.—Production primarily for local use is the aim of Sierra agriculture. Farmlands occupy the available areas to an almost incredible degree of intensiveness, for in his many centuries of living in the Sierra, the Indian has become essentially a farmer. In the heights his brethren, the shepherds, seek every utilizable patch of grazing land for the wandering flocks of sheep and llamas.

Though having farmed during the centuries, the highland farmer has developed only rudimentary and inefficient agricultural methods. This situation promises to continue indefinitely because of the widespread illiteracy and rigorous physical conditions. But the average native appears satisfied; he has few needs and practically no ambition;

some food, some vile intoxicant—*chicha*—a few diversions, and he desires little else. The foot-plow agriculture, characteristic of the high root-crop zone where a tough sod occurs under the grass cover, furnishes a good example of his technique. Under this system it requires three laborers to turn one bit of sod. Two pierce the soil with the diminutive foot-plow, pry up the sod, and the third turns it over. This is difficult work at these altitudes, but the custom has persisted since Inca days. In the lower districts on more arable soil, the farmer makes use of the hoe, while in some sections a crooked stick drawn by oxen scratches the soil. Planting, tilling, and harvesting are all done by hand. Many crops are threshed by flails or by driving animals over them on earthen or stone floors.

Methods of land tenure show great differences. In certain areas, huge *haciendas* exist; they represent early land grants to Spanish noblemen or soldiers. Elsewhere the land is minutely parcelled and the individual Indian owns his tiny plot of carefully tilled soil; in other places Indian communal organizations hold and farm the land in common.

The Crops.—The Sierra produces a variety of temperate cereals, vegetables, and fruits; they represent a zonal distribution resulting primarily from differences of temperature with altitude. The lower, mild, temperate valleys and slopes from 8,500 to 11,000 feet grow the variety of produce; the *Altiplano* and high *pampas* support only four or five crops; the rigorous climatic conditions of the *páramo*, prohibit the production of crops at these incredible altitudes—14,000 to 16,500 feet.

The mild valleys and slopes, with considerable sunshine, fair amount of rainfall, much water for irrigation, fairly friable soils of generally low fertility, are checkered patchworks of cereals, vegetables, and fruits. The cereals and vegetables grow throughout these altitudes and occupy much of the land to the exclusion of pastures, but the fruits which include only apples, pears, cherries, and chirimoyas, and which are slightly cultivated in a desultory fashion, drop out at the middle altitudes. In general the fruits grow not in orchards but in hedges along the roads, or streams, and around the cultivated patches.

Indigenous to the valleys, corn is one of the staple articles of diet for both men and animals. The lower classes obtain also their most

popular drink—*chicha*—from corn. It does fairly well even on rough and stony land, though yields vary greatly. It grows in all parts of the region, particularly in the irrigated districts, and attains an elevation of 11,000 feet, though optimum growth comes below 8,000 feet.

Wheat also is grown in all parts of the region, though chiefly in the non-irrigated districts, because of its small requirements of water. This cereal's great adaptability makes for a notable irregularity in conditions of production. It can produce crops at 13,000 feet but it does not ripen well at the upper limits of cultivation; it may be grown either as a summer crop or a winter crop. More than 700 primitive mills in the producing districts grind most of the flour. Though the Coastal Desert grows little wheat, only small quantities leave the Sierra, both because of the small total production and the expense of shipment from the highlands (Fig. 91).

Essentially a highland temperate crop, barley, although grown in all the lower valleys, replaces corn and wheat in higher areas where low temperatures, danger from frost, lack of sunshine, and the stony piedmont soils or damp cold soils prevent tillage of wheat and corn; here it becomes one of the three dominant crops, occupying a large part of the land under tillage. It does not mature any too well under rigorous conditions, but in sheltered mountain nooks it grows at altitudes up to 14,000 feet. It yields well on poor lands and while it can withstand the cold and droughts of the wind-swept *pampas,* much of the crop is cut green for want of ripening sunshine.

Practically unknown in the channels of world trade, a small-grained cereal known as *quinoa* becomes one of the three chief crops from 12,000 to 14,000 feet. The Indians have produced it for centuries as it thrives on thin stony soils and yields abundantly. In addition to providing its white to brown seeds approximating the mustard seed in size, the plant becomes useful in several other ways: the young tender leaves flavor soups and stews; stems and coarse leaves, reduced to ashes, are chewed with coca leaves. The seeds themselves are used for making porridge or soups and for rough flour which is baked into a hard nourishing bread of astonishing keeping qualities, which, carried by every Indian shepherd, porter, or llama driver, serves as the chief food on the trail.

Supplementing the cereals, the root crops of the Sierra have considerable importance in the region, the potato ranking next to corn

FIG. 91

From southern Bolivia to eastern Venezuela wheat in small fields tints the hillsides from 7,000 to 10,500 feet elevation and constitutes an important foodstuff.

as a food (Fig. 92). The potato may not be so nutritious as the cereals, but it endures the low temperatures even at elevations of 14,500 feet and gives a fairly good yield per acre on stony soil. The native recognizes a number of varieties, but most of them are small,

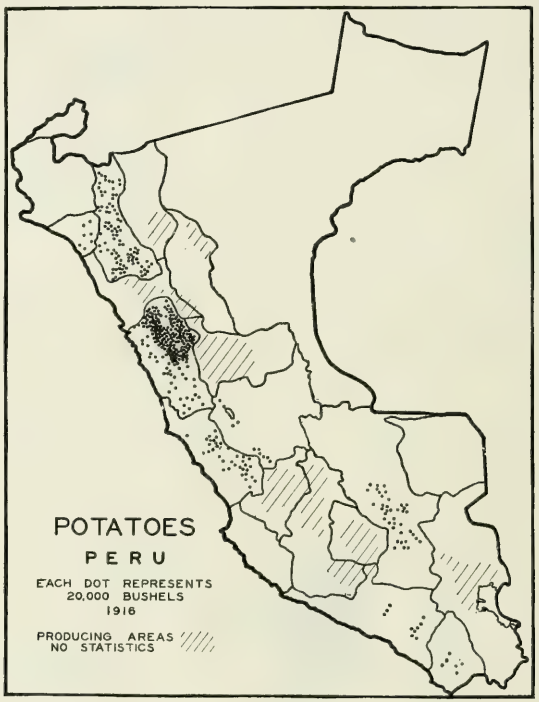

Fig. 92

In its native home the Irish potato supplies a vital food for the highland Indian, often growing under adverse conditions of soil, temperatures, moisture, and methods of tillage; it does not grow on the lowlands.

rough, fine-textured, but very firm,[1] and varied in color, yellow being the common internal color. For long preservation much of the crop is put up as *chuno*, prepared by alternately freezing and thawing the tubers, and used in soups or stews (Fig. 93).

Growing at elevations even greater than those attained by the potato, and under more rigorous conditions of terrain and climate,

[1] A traveller unacquainted with the degree of firmness of the yellow boiled potato, on placing a fork on it to mash it on his plate, more often finds it in the lap or plate of his neighbor than crushed in his plate. Thus, embarrassed, he will slice it with a knife.

oca and *olluco* are both valuable tubers to the under-nourished Indian, while in the warmer valleys the *yucca* may replace both corn and potatoes.

Grazing.—As a rule the highland Indian is fundamentally pastoral as well as agricultural; he must be self-sufficient to a large degree. Though various animals, in consequence of widespread forage, may be grazed upon most highland areas not occupied by crops or covered with salt plains, snow fields, and ice caps, the ranges fall into three

FIG. 93. SORTING POTATOES, LAKE TITICACA

Following a good season, the natives use every means of preserving the valuable food; where the women do the work and the men look on.

distinct types. They embrace (1) the alfalfa pastures in the valleys, fallow lands on the slopes and mountain ridges above the tilled fields bordering the valleys, (2) the drier portions and swampy tracts of the *pampas*, and (3) the cold, raw, damp *páramo*, where grazing constitutes the only occupation.

The valleys and adjacent slopes support the greatest variety of animals—cattle, mules, pigs, sheep, and llamas—grazed on stone-fenced inclosures or on high slopes in care of a shepherd. The animals go to the pastures each day and return at night to the stone corral. Here grazing supplements crop production; it is not the chief concern of the inhabitant. Herds and flocks include smaller numbers of animals than on the other ranges. This lower range consists of stony

rough mountain land, whose carrying capacity averages about one cow to 9 acres.[2] Mules are raised chiefly for pack animals and for distribution to mining centers. Cattle constitute the chief animals; each Indian family cares for a few cows and steers, some considerable milk being used in this zone. Steers and bulls serve chiefly as a meat supply as on the steep mountain slopes few can be used for tillage; this is the zone of foot-plow agriculture. As in other parts of the highland the cattle are of low grade, descendants for the most part of old creole stock. Long-horned, tall, bony and slaughtered in poor flesh, the steers cannot yield prime meat. Swine and many chickens often tethered by children supplement the food supply.

On the middle range of the broad wind-swept *pampas* different conditions prevail. Scattered tufts of *ichu* and other bunch grasses and individual spears of short grasses springing up after each period of rains, afford a carrying capacity of about one cow to seven acres; many areas poorly watered suffer from droughts that cause considerable losses. Most of the animals of the highland region are supported by the middle ranges. Here, individual ranges include vast areas; separate flocks and herds number thousands of animals. For many Indian families the care of the animals becomes the chief concern of the inhabitant; tillage of the soil often secondary. Animals always graze under the care or eye of a shepherd man, boy or woman, who frequently spins yarn while tending the flock. Though herding many animals belonging to the *hacienda* flock, each family possesses a small number, inherited, bought or stolen. Cattle become the chief draft animal for breaking the ground with a wooden plow pointed with steel. The plateau Indians use little milk, but they eat considerable meat. Many cattle, pigs, and chickens are tended, but sheep, llamas, and alpacas constitute the chief animals.

To the Indian, sheep constitute an invaluable resource, from which he obtains food and clothing. As with tilled crops, the industry rests in a rudimentary condition. The sheep show an astonishing range in color, from black through myriad shades to near-whites, and are a comparatively diminutive type. Though the yield of wool averages far under that of sheep in Patagonia or the Pampa, it is unusually clean because of the absence of burr and prong-bearing plants. On

[2] Five to six sheep equal one cow; six to seven llamas equal one cow; four to five alpacas equal one cow.

the market, however, the wool ranks low in quality because of the inferior breeds of sheep and the crude methods of shearing, baling, and shipping. Generally, the sheep-raising *haciendas* embrace large areas, subdivided for the numerous flocks ranging in size from a few hundred to several thousand head. Commonly only the higher pastures are cropped in the summer, those at lower altitudes serving as a winter reserve. More than two-thirds of the sheep in the Sierra graze

FIG. 94. LLAMA TRAIN

An excellent beast of burden is the llama, which can subsist on little forage, picking its food as it proceeds and at night, do without water for days, and carry 100 to 150 pounds. The llama usually has a load of 101.43 pounds, a unit of measurement for the highland region.

in the far south, on the lands north and west of Lake Titicaca in the departments of Puno and Arequipa.

Much less numerous than sheep, llamas are the principal beasts of burden of highland Sierra (Fig. 94). The handsome docile animals form as much a part of the Sierra picture as the Indian. Long caravans may be seen frequently carrying the produce of various sections. In addition to its service as a carrier, the animal requires little attention in respect to feed, can go long distances without water, and also clothes the Indian with its wool, furnishes fuel from manure carefully gathered and dried, and provides meat, fat, bone, and leather when it

inadvertently falls over a cliff, breaks a limb, or dies after a life of many-sided utility to its owner.

A large part of the wool moving out of the region consists of alpaca wool. Kept almost solely for their wool, although the Indian frequently uses the flesh for food, the animals also require much more attention than llamas. The pasture must be better, pure water is essential, and it does not carry burdens. Yet once in two to five years it yields a large clip of especially fine quality. In distinct contrast to the careful breeding during Inca days, today flocks consist of a great diversity of colors. Practically all of the animals belong to the Indians and are kept in flocks ranging from 50 or 60 to 2,000.

As with other livestock, the cattle of the Sierra are generally a nondescript lot, including many colors and averaging a low weight. The problem of providing sufficient feed is a serious one, but the utility of the animals for food, leather, and draft purposes makes them important fixtures of many farms. Owing to available markets on the coast, efforts to improve stock have been made, but the great altitudes prove harmful to imported breeds. To reach the coastal consuming centers, the cattle go by two routes. In one they descend the slopes at a time when the natural pastures, in the zone of fogs on the western slopes, are in good condition; here the cattle move slowly in order to fatten. Then they proceed to market, although some *hacienda* proprietors own alfalfa pastures in the irrigated valleys where the cattle may go through a period of fattening. Producers near the railroads utilize the second route and ship their animals by train directly to market.

The Mineral Industries.—To the foreigner, the Sierra's greatest economic significance has lain in the enormous mineral wealth locked in the mountain fortresses. The silver and gold which in early days so aroused the cupidity of Spanish adventurers led to the profound changes in social and economic life resulting from the dissolution of the Inca empire. Today, the minerals have come to embrace less precious types and their exploitation has caused fewer modifications in Sierra life, but they still retain great importance to the region.

Copper.—With the decline of silver production in the Cerro de Pasco region during the closing years of the nineteenth century copper came forward to take its place in the very region which silver had dominated for centuries. The output of copper, most of which is exported, increased from 1,000,000 pounds in 1894 to 97,000,000

pounds in 1923. Before the World War (1910–1912) copper led the exports of Peru with one-fourth of their total value; in 1928 it held fourth with 16 per cent of the total.

Many fairly high-grade copper deposits exist in several parts of Peru, but more than 90 per cent of the output comes from the Cerro de Pasco, the Morococha, and the Casapalca mines in central Peru. The growth of the copper industry here has taken place in the face of colossal handicaps of labor, transportation, fuel, and other supplies.

The high elevations of the workings (Cerro de Pasco lies 14,400 feet and Morococha 14,800 feet above the sea) render the operators entirely dependent for heavy labor upon the native Indian who is inured to working in rarefied air. Managers, foremen, geologists, and engineers must be brought in from the outside world at high salaries. They are forced to go down to sea level once or twice a year to recuperate from the enervating effects of the high altitude. All this greatly increases the overhead expenses of copper production.

The Cerro de Pasco and the Morococha deposits lie on the eastern side of the western range of the Andes. They are reached by the Central Railway of Peru, which crosses the range at 15,680 feet and terminates at Oroya, while private branch lines also serve them. To connect the Cerro de Pasco mines with the Central Railway at Oroya the Cerro de Pasco Copper Corporation constructed a railway for 82 miles across mountain and plateau country. The same company also built lines to Morococha and to some coal mines near there. This development work entailed an enormous outlay of capital before production could reach respectable figures. The significance of rail-transportation facilities in the mining industry of Peru may be shown by the fact that more than 90 per cent of the total production of copper comes from this region, tributary to the Central Railway of Peru and branch lines, and that this is the only region adequately served by rail transportation.

Structural timbers, steel, machinery of all kinds, clothing, most of the fuel, and even food products must be brought in from the outside. This can be accomplished in a large way only where adequate transportation facilities exist. It is under these conditions that the Cerro de Pasco Copper Corporation has come forward as an important copper producer, and to this company Peru largely owes its position as an exporter of copper (Fig. 95).

The growth of the copper industry of Peru will depend upon continued development in the old regions and the opening up of new districts. Although it is true that rather extensive deposits are known to exist in various parts of the Andean Highlands of Peru, before a marked growth can take place foreign capital in large quantities must be available; transportation facilities must be constructed across barren deserts and over almost insurmountable mountain barriers; and concentration mills, smelters, homes for the people, and even

FIG. 95. COPPER SMELTER, OROYA

This new great smelter of the Cerro de Pasco Copper Corporation smelts most of the copper of the republic and much of the silver. Located in a region of fairly dense population at 12,500 feet, the smelter, as a result of fumes, has killed the vegetation on the valley sides for miles. Community Indians not willing to give up their lands are being fed by the corporation by government request.

hospitals with modern equipment must be provided at the new copper camps. At best, all this will evolve but slowly; yet with the prevailing demand for copper in the world's marts Peru will continue for some time to produce considerable quantities of the metal and to purchase all equipment and supplies required in the industry.

Miscellaneous Minerals.—Silver, produced in many parts but chiefly in the Cerro de Pasco district, in connection with the copper workings, still retains considerable importance among Peruvian minerals, ranking second among the metallic minerals in value of yearly output. In recent years, the exports of silver in various stages of refinement have averaged close to $3,000,000 per year.

Other than copper and silver, the Sierra mining industry yields a large variety of less important minerals, including principally: vanadium, gold, tungsten, lead, bismuth, antimony, molybdenum, mercury, and zinc. Most important among these is vanadium. In the Minasragra deposit, located a short distance west of Cerro de Pasco at an elevation of 16,500 feet, Peru has the major vanadium mines of the world and enjoys a virtual monopoly in this important alloy metal.

Sierra Manufacturing.—Except for basic processes in preparation of foods and elementary manufactures, the Sierra exhibits little manufacturing development. The people have few needs, and home industries provide for most of them. Every Indian woman is adept at making substantial clothing and blankets from the wool furnished by the family's flocks of sheep, llamas, or alpacas. Moreover, the low purchasing power of the people further prevents large-scale industrial development. The most advanced industry of the Sierra is that of textiles, Cuzco having three woolen mills.

That the region can develop important manufacturing industries in the near future seems unlikely, owing to the factors indicated in the foregoing and in addition to the lack of inexpensive fuels. Coal exists in various parts, but the character of the beds and their isolation in almost inaccessible valleys makes exploitation too costly except for certain large mining camps. Even provided the problem of fuels were solved, there remains the fact of a notable dearth of skilled or easily trained labor.

THE OUTLOOK

Unlike many regions of South America, the Sierra stands on no threshold of possible great expansion. Whereas areas like the Pampa, or the Central Plateau of Eastern Brazil, or even the Peruvian Montaña show possibilities of notable advance either in the immediate or the remote future, the Sierra on the other hand remains static. The geographic conditions of the region seem to have crystallized into an economy of long-enduring character. Mineral industries may come and go in a sudden flaring up and dying away, but the basic activities of the Sierra—tillage of crops and grazing—are permanent. The Indian laboriously scratching the soil of his highland farm or following his herds to the next patch of meagre forage constitutes

as much a part of the land as the soil itself. He has no particular interest in the future of his habitat and he is not likely to witness much change.

Conditioning all activity is the fact that this is a highland region. The climate permits only certain crops to mature; natural vegetation lacks woody forms; the amount of arable land is restricted. Of greater import, however, is isolation due to difficulties of communicating with the lowlands to east and west. All of these are factors which may undergo modification, but the intimate contact of the Indian with his region always will illustrate what a handicap his land provides. Moreover, the towering mountains and high plateaus, where the Indian can scarcely rise above a bare subsistence living, have erected a topographic and climatic barrier which may forever keep the Indian in his native haunt, isolated and far removed from the life of the republic as a whole.

CHAPTER XV

THE MONTAÑA[1]

From Colombia to Bolivia, the four countries sharing the western parts of greater Amazonia have had painted before them lurid pictures of possibly incredible wealth in their eastern possessions. In Peru, this has been especially true, but as in Bolivia, Ecuador, or Colombia, the hot, humid, forested east as yet has constituted no El Dorado. The geographic handicaps of (1) Amazonian characteristics in physical set-up, and, more notably, (2) distance from the sea on the east and presence of the Andean mass on the west will prolong possibly for centuries the comparative unimportance of the Montaña.

Except along the principal rivers, the region has a strikingly sparse population, less than one person to 4 square miles. At most it contains only 4 per cent of Peru's total population; a large part of whom are concentrated at Iquitos, the largest settlement. The white element is conspicuous by its paucity. Only the native Indian, accustomed to his land, remains permanently attached to the region. So much of the area lies unexplored and even untouched that thousands of the Indians still abstain completely from the commercial intercourse with outside influences. They simply pursue an unhurried existence, reaping a few easily raised crops or hunting and fishing when in the mood. Their necessities are few and readily obtained: food abounds; the forest furnishes shelter; a piece of cloth and possibly a string of teeth or beads provide raiment. Among themselves, too, the aborigines mingle little; different tribal groups to an estimated total of 115 hold various sections of the land, the most numerous living in the north about the Putumayo, and Napo Rivers.

Iquitos, on the Amazon, far overshadows any other settlement of the region. Because of its large floating class, its population is variously judged at from 12,000 to 20,000. Practically all of its growth has depended upon the rapid rise of the rubber industry following 1880, when the immense advantages of a river port available for

[1] In a strict sense, the term montaña includes only the forests of the eastern plains, but here it applies to the thickly forested Andean slopes below an elevation of some 5,000 feet.

ocean-going vessels at 2,300 miles from the sea made Iquitos the "boom" city of western Amazonia, just as Manáos sky-rocketed as a result of similar conditions in central Amazonia. Today, after the decline of rubber, Iquitos, nevertheless, holds considerable importance, shipping, in addition to rubber, the many products of diversification—chiefly cotton and tobacco. It has also a few industries, such as saw milling, the manufacture of straw hats, soap making, cotton ginning, and distilling.

Older smaller settlements have developed particularly in the zone of forested slopes known as the *ceja de montaña*. At an early day, gold, salt, and agricultural possibilities in the deep fertile, though unhealthful, valleys of this area attracted both Indian and Spaniard from the Sierra, but most of the outposts, established chiefly by Jesuit missionaries, found the difficulties of exchange with the plateau too great. For most of the region, even the wave of searchers for cinchona bark left little impress in the way of villages. Of the early concentrations, Moyobamba, in a zone of savannas as well as dense forest, has become the leader. Livestock, cotton, tobacco, sugar cane, and relatively good access to the Huallaga River and thereby the sea, have given Moyobamba a population of 5,000. Though the plateau is less readily reached, the route via Cajamarca permits the exportation of straw hats by way of the Pacific.

In the cases of Iquitos, Moyobama and of any point in the Montaña, the critical importance of transportation is discernible. Remoteness, which will eternally hamper life in the region, colors all activity. Villages develop only where a key position with respect to navigable rivers leading eastward, or possible trails leading to the Sierra, is available. Of the two conditions, the river site is the most weighty. The rivers almost alone make possible such economic life as has developed and every streamlet affording a degree of navigability has been sought out, principally in connection with the gathering of rubber.

PHYSICAL SETTING

Like most of Amazonia, the Montaña consists principally of a gently sloping alluvial plain, across which its many large rivers wend their rather leisurely way between low and frequently inundated banks. At the west the plain rises into the sharply dissected foothills and lower slopes of the Andes; a large part of the region has an elevation under

1,000 feet. Here most of the agriculture of the region is practised, although river flats in the eastern sections may serve as farm land (Fig. 96).

Climatically, the bulk of the Montaña is the close counterpart of Amazonia in eastern Bolivia, western Brazil, eastern Ecuador, and eastern Colombia. Hot and humid are the usual descriptive terms which amply characterize the debilitating monotony of the warmth of the muggy atmosphere over much of the region and suggest the

FIG. 96. A FERTILE VALLEY NEAR TARMA, PERU

Temperate crops on the hillside to the right; subtropical crops in the valley; along the western border the Montaña consists of deep valley and mountain country; the eastern end of an automobile highway from Oroya.

liability of all inhabitants to ever-lurking tropical diseases, notably malaria. Practically all of the region has an average annual rainfall of more than 50 inches and a good portion of more than 80 inches, considerable amounts, except in the far south, falling in all parts of the year.

The vegetation produced by the combination of alluvial soils, heavy rainfall, and great warmth has exceptional luxuriance. Though the forest of the plains has numerous valuable timbers, distance from the sea limits lumbering to only a few favorable located points. More important than timber is rubber, once the sole reason for prosperity in the Montaña, and *balata*. On the higher western lands the true Amazonian forest grades into a zone of tropical forest partially oc-

cupied by savannas. The combination of grazing, tillage, and forest activities has given rise to the leading towns of the slopes—Moyobamba in the north, Santa Ana in the south. Above this district lies the forest of arborescent ferns and cinchona which at one time made the eastern slopes of the Peruvian Andes world-famous as the one great source of quinine.

ECONOMIC ACTIVITIES

Since the days of quinine- and rubber-prosperity, the Montaña has had little briskness in its commercial life. The region has exceedingly fertile soils and a large expanse of only gently undulating, though forested, land. The principal handicaps, however, of remoteness and dearth of labor limit possible production in both forestal and agricultural exploitation.

Rubber still engages many of the people, though to far smaller extent than in previous years. With the beginnings of rubber-gathering in 1882, the region entered an era of development far more comprehensive than that accompanying the settlement of the upper valleys by men in search of cinchona. Though *Hevea brasiliensis* and *Hevea Andenensis* supply some of the output, the Peruvian rubber consists chiefly of *caucho* from *Castilloa elastica*. The district of major development lies among the upper Ucayali, Juruá, and Purús Rivers, whence practically all of the product descends the Ucayali to Iquitos for shipment abroad.

Among the forest products, of greater present significance than rubber, is *balata*. The gum comes from all parts of the region and is of good quality. Exports far exceed those of rubber in value.

As yet, agriculture has made no conspicuous advance, but since the collapse of rubber the region has produced increasing amounts of several crops. As practised by the native supplying his own needs, Montaña agriculture, exceedingly primitive, is carried on with the crudest of implements. The common subsistence crops, generally raised on tiny desultorily tended patches, consists of cassava, sugar cane, corn, and various vegetables.

The crop most characteristic of the region is coca, grown on the terraced slopes of many of the upper valleys. Conditions of climate and soil prove almost ideal, three or four crops being secured annually; the shrub thrives best at from 2,000 to 5,000 feet; the one great deter-

rent is paucity of labor. Most of the crop goes to the Sierra. The extraordinary powers of endurance and resistance to cold and hunger to be had by chewing the cocaine-containing leaves give coca a wide sale in the Sierra, the market quickly absorbing new supplies.

As with coca, other commercial crops of the region have high value per unit of weight, in order to meet the expenses of carriage to the Sierra. Hence cotton, tobacco, sugar cane, cacao, and coffee rank as the principal crops sent from Montaña to Sierra. Of these cotton has shown the greatest progress (Fig. 97). All suffer from the lack of

Fig. 97. On Rio Alto Huallaga, Peru

Bales of cotton collected from adjacent districts being assembled at river docks for shipment down river to Iquitos and Pará for export; largely ungraded and poorly ginned and baled this cotton can not enter select markets. (*Courtesy of Dr. Arelino.*)

labor, crude methods of agriculture, inadequate transportation facilities, and lack of grading or standardization.

An analysis of Montaña prospects for future development involves a reiteration of conditions affecting all of Amazonia. At the very best, progress in the region must be slow. No great commodity, such as rubber at an earlier day, shows any indication of attracting people to this remote land. Sparsity of peopling and isolation are the almost supreme controls of the situation. Immigrants will not move in large numbers into an undeveloped land like greater Amazonia; and distance from the sea, in actual miles, and from the Sierra, in terms of hardships, is not an easily dismissed problem. Peru will expend much effort and money in developing the Coastal Desert and the Sierra before turning definitely to the Montaña.

CHAPTER XVI

BOLIVIA

The inland republic of Bolivia partakes in many respects of its northern neighbor, Peru, of which during most of the colonial period it formed a part, being known as *Alto Peru*. In the major features of its physical make-up, in historical evolution, and in some phases of economic development, it resembles Peru. With an estimated area of 514,000 square miles it almost equals the area of Peru, but it possesses only half as many people (2,800,000), and has only one-fourth as much commerce as that west coast country; likewise, it lacks a productive coastal desert, which rejuvenated the economic life of Peru

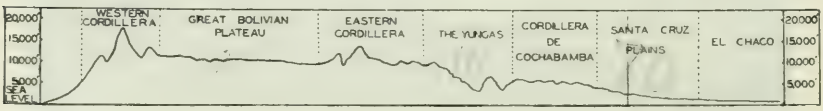

FIG. 98

A profile of Bolivia on latitude 18½° south. (Based in part on the sheets of the "Map of Hispanic America," 1:1,000,000, American Geographical Society.)

after the collapse of the guano industry and the close of the War of the Pacific.

From the north two majestic mountain zones, extending southward across the country, the Western Cordillera in the west and the Eastern Cordillera or Cordillera Real nearly 200 miles to the east, exhibit colossal snow-crowned summits, inclose the high bleak Bolivian plateau, and possess in their remote fastnesses the mineral wealth for which this republic has been noted for centuries. Among the highest on the continent, their high peaks, Illampu, Illimani, and Huayna Potosí tower to more than 20,000 feet above the sea, while a score of others rise to almost that elevation. In the ranges all the important passes lie between 12,000 and 15,000 feet. Between these zones stretches the broad central basin or the *Altiplano* of Bolivia, remarkably flat over large areas, in spite of numerous irregularities of

surface. To the east the deep valleys and steep slopes of the Yungas separate the bold Andes from the extensive low and sparsely inhabited plains of eastern Bolivia. These three major sections of the country embrace respectively about 20 per cent, 10 per cent and 70 per cent of the total area. Complementary in many respects, they have developed an individual economy except for the Yungas, which is a true border zone between the temperate and tropical portions of Bolivia, and which takes on physical and economic aspects common to both (Fig. 98).

HISTORICAL BACKGROUND

Though a country of topographic and climatic contrasts and extremes, much of Bolivian history has been enacted in the small western portion of the republic, the Andean Mountains and Plateaus and in the adjacent Yungas. Except for the rubber boom, the vast plains of the east, harboring backward and hostile folk, have witnessed little development. But in the highland portions a long historical evolution has left an indelible stamp on present Bolivia.

Near the south end of Lake Titicaca, with the capital at Tiahuanaca, rose one of the most advanced and oldest civilizations of all time. While a lower elevation and more moist climate, eleven thousand years ago or more, may have fostered development, the region possessed certain conditions that favored the advance of a primitive people beyond the first stages of savagery. The region was hemmed in by topographic or climatic barriers affording protection from neighboring peoples. In the region people had to work for a living; to produce food man had to till the land, irrigate the soils, and tend flocks on high mountain pastures or on lands lying fallow. The low temperatures and the uncertainty of yields forced the preservation of food at the end of a good harvest to provide for lean years. Pressed by necessity, a strong communal organization arose, every little community being strongly bound to the land. How long this great civilization flourished is a matter of dispute, but their monuments, carvings and buildings denote a high order of development. After the zenith of this ancient civilization a new civilization arose.

In the lands of these ancient folk the Aymará civilization developed. It was spread over the whole plateau area, except possibly the more arid southern part. It consisted of an agricultural people chiefly, of

organized village communities, the people being as tightly bound to the land as were those of more ancient times. But the Aymará peoples lacked the skill of their predecessors.

Then came the Inca rulers with their greater power for organization and control. As in the adjacent lands to the north, agriculture, irrigation, communications, and construction reached a high order (Fig. 99). Food was stored and the sick and old cared for by the community. But the great mass of population advanced little, if any.

Fig. 99. The Island of the Moon, Lake Titicaca

Scenes and remains of ancient civilizations; stone structures, roadways, irrigation facilities and painstakingly tilled terraced slopes indicate the high order of development of these people at the Spanish advent. (*Courtesy of L. D. Gismondi.*)

The person of the lower classes lived in a sphere defined by a paternal government; no force could elevate him in the social scale or advance him in any way. Highly sedentary, wedded to the precious farm land, skilled along one line, and relieved of responsibility, the inhabitants of each community fell an easy prey to the Spaniards, once the great leaders of the Inca Empire had been relieved of their wives and their heads.

With the Spaniards came an age of bloodshed and revolutions. After the *Conquistadores* butchered their way to the controls of the Inca Empire, which took but a few years compared to the conquest of Chile, disagreement arose and they fought among themselves. Intent, chiefly, on gaining possession of the wealth of gold and silver

in the region, the Spaniards paid no attention to agriculture; they enslaved the Indians; roads, posts, storehouses, and canals fell to decay. The gap between ruling class and common people widened. The maltreatment of the Indians by the Spaniards added to the difficulties of life in the cold highland. Though the rich placers and vein workings of the highlands supplied half the civilized world with gold and silver for centuries,[1] this mass of wealth benefited the Indian not a bit and farming the worn-out, neglected fields gave but bare subsistence.

As in many other parts of South America, the birth of the republic in 1825 did not bring peace to Bolivia. Presidents installed themselves by force of arms and were soon relieved in like manner by rivals. Unstable political conditions prevailed for more than fifty years. Spreading over the bleak wastes of the Cordillera, peopled by widely divergent Indian groups to which had been added a small inkling of Spanish blood in contrast to Chile, and lacking the compactness of early Chile protected by its persistant Andean, Frontera, and desert barriers, early Bolivia failed to develop the solidarity and aggressiveness characteristic of its southwestern neighbor. Drawn into war with Chile over an export tax on nitrates from Antofagasta, Bolivia in 1879–1881 lost 30,000 square miles of territory in the province of Antofagasta, its valuable nitrate and copper deposits, and the outlet to the Pacific, from which the country can never recover completely. Had government officials pursued a definite policy of aiding the Chileans in the development of the nitrate deposits in Antofagasta in the years 1866–1878, Bolivia might have retained the Pacific outlet and the great wealth that put Chile in the front rank of the Pacific Coast countries. Since 1880 several presidents have retired from office under force of arms, but conditions on the whole have been far better than formerly.

Though Bolivia is a republic, the republican form of government in the true sense of the term scarcely functions, owing to a number of

[1] The discovery in 1545 of the great silver mines at Potosí at once made the Bolivian plateau the most valuable and important province of the Spanish American Empire. In 1571 the discovery of quicksilver mines farther north augmented the mineral output; in 1575 the Oruro mines were developed and before the close of the century the copper pan amalgamation process invented in the region revolutionized the production of silver. Potosí, through its mines, controlled the money markets of the world for a time; in the seventeenth century it became the largest city in America with a fluctuating population of from 100,000 to 170,000; its fame was world wide.

conditions. Highland and Lowland Bolivia have nothing in common. Most of the people live in the highlands but there the inhabitants are not united.

POPULATION AND LIVING CONDITIONS

As in most other South American republics the population of Bolivia consists of three major classes: the white element, the *cholos,* or mixed white and Indian blood, and the Indians (Fig. 100).

The small upper class comprising not more than 13 per cent of the total population, consists of the descendants of early Spaniards and

FIG. 100. ON THE SHORE OF LAKE TITICACA

A lowly Indian dwelling; the mother and little daughter have just returned from the hills with the sheep and cows; the father and son are fishing on the lake in a *balsa;* without sheep the highland Indian could hardly subsist in the cold bleak heights.

more recent immigrants. This class controls the wealth, the best agricultural lands, the politics, and the education of the country. With this class the inland position of the country and the meagre transportation facilities caused the development of a provincialism that long delayed modern development, and that formed obstacles to political unity.

The mestizos, persons of mixed blood, locally known as *cholos* or *cholas,* the product of the mixture of Spaniards and Indians, share the qualities of both. They lack initiative and persistence, but they are superior in intelligence and utility to the Indian. The *cholo* occupies a major place in industry and in the political life of the country; he furnishes nearly all the skilled labor and some of the unskilled; the superintendents of the large estates are *cholos;* most of the shops in

the towns and the stalls in the public markets are kept by *cholos*. Also, most of the servants come from this class. Different gradations of *cholos* are marked by the degree of prosperity, standing of occupation, or proportion of white blood in their veins. The proportion of *cholos* in the population ranges greatly from one section to another. In the highland and in the eastern lowland they comprise a small

FIG. 101. INDIANS DANCING ON THE "ALTIPLANO"

After a bountiful harvest the Indians celebrate with a three-day feast of dancing and merry-making. The woman at the right, dressed in gaudy-colored waist and skirts, is doing a flat foot *whirl* on stony ground; the women wear many skirts, the number indicating, in a way, the positions of the wearer in the social scale of the village; no two adjacent skirts are of the same color, so one can easily count them.

part, but in the Yungas *cholos* may constitute 50 per cent or more of the total population. The mestizo of Bolivia, with a goodly percentage of Indian blood, does not compare with the mestizo of Chile.

Separated by a wide gap in every way from the whites are the Indians of Bolivia. Indians comprise more than one half the total population of the country. They are dominant in the highlands and in the eastern lowlands. The great majority of the Indians of Bolivia belong to two classes, the Aymará and the Quichua, both of which inhabit the highland region (Fig. 101). Besides these two principal

Indian tribes, there are large numbers of minor tribes located in various parts of the republic. They vary in civilization from the Indians of the Monte Grande and the ferocious Sirionos of the Mamoré forests to the peaceful Indians of the Yungas.

Everywhere the lot of the Indians seems to be a disagreeable one. In the lowland the Indian struggles against heat, vegetation, diseases, and insects; in the highland he ekes out a bare subsistence from the cold, bleak areas.

The highland Indian dwells, for the most part, under pathetic conditions. The stony infertile soil under uncertain precipitation, low temperatures, and poor methods of culture gives low yields of a few inferior crops—potatoes, barley and *quinoa*. Beef and mutton are tough and stringy. Living above the tree line, the Indian resorts to *tola*, *llareta* and *taquia* for fuel for cooking over an open fire outside the hut. The food is poorly prepared and insufficiently cooked because of poor fuel and the low boiling point of water—185° at 14,000 feet. A much longer time is required to cook the food than at sea-level; this becomes a serious handicap with little fuel. Shivering through the night in a damp adobe hut, the Indian crawls out as soon as the morning rays of the sun bring warmth. The lowly huts, without any furniture, are never heated—fuel is too expensive. The Indian has no medical attention; he seldom bathes in the icy waters from off a snow or ice field. In addition he suffers from diseases and the excessive use of coca and alcoholic beverages; these deaden the system and stupefy the mind to the rigorous physical conditions and to the oppression by the upper classes. Finally, a child born into this class has little or no chance to rise above that plane of living. He is destined to become a tiller of the soil, herder of the flocks, laborer in the mines or a llama driver, trudging over bleak cold heights and stony trails and stopping where night overtakes him.

The small upper class of white population seems to have little regard for the Indian, except as a burden bearer, a laborer in the mines, or as a contributor of taxes from the poor communal lands and meagre flocks. The *cholos*, shop keepers and traders, do not bridge the gap between Indian and white. The Indians, speaking different tongues, do not read or write; they seldom visit any of the large cities; they come in direct contact with the government only through the tax collector or with the soldiers when they stage an uprising or become

disorderly. The official language, Spanish, touches a small part of the population. As a result of this combination of conditions, political disturbances and uncertainty have deterred expansion along all lines.

TRANSPORTATION

Isolation, with consequent shackles of inferior transportation, likewise exerts its retarding influence. This remote area, among the clouds, is one of the most isolated countries in the world. Only four difficult rail routes and two little used waterways afford contact with the outside.

Three railways afford Pacific outlets to some of the plateau cities and mining centers. The shortest line from La Paz (276 miles), after passing near the famous Corocoro copper district and scaling the continental divide at 13,986 feet, descends for 24 miles on a continuous rack system with a grade of 6 per cent to 7,200 feet; it then runs down gradually across a barren country and along a narrow irrigated valley to the sea at Arica in Chile. The northern route, almost twice as long as the aforementioned line (529 miles), has a connecting link of water on Lake Titicaca, crosses the continental divide at 14,688 feet, and reaches the sea at Mollendo, Peru, one of the roughest harbors on the entire west coast. The Antofagasta-Bolivia Railway, the longest of the three (727 miles from La Paz to Antofagasta), taps the main mineral section of the country and as a result is the chief outlet, in spite of the elevation of 12,970 feet reached at the divide. These three lines, although operating under great difficulties, carry almost 90 per cent of the tonnage of foreign trade. Eastward, the railway line (La Paz to Buenos Aires, 1,637 miles), completed in July, 1925, taps the southern mineral sections of Bolivia, but owing to the long haul, the high cost of fuel, and the change in gauges it does not serve as an important conveyer of freight. The two river routes, the Paraguay-Paraná and the Mamoré-Madeira-Amazon, each with a length of more than 2,000 miles, afford inefficient transportation for the sparsely inhabited lowlands of the eastern part of the country.

Internal communications are far inadequate, restricting commercial activities and retarding mining developments. With seven times the area of Uruguay, Bolivia has only two-thirds the railway mileage of that small country. It has only 260 miles of automobile roads

passable throughout the year, and about 2,500 miles usable during the dry season. They are all of dirt, for modern paved highways do not exist in Bolivia. Primitive pack-animal transportation throughout the plateau and mountain zone supplements the few railway lines which reach the chief centers of the departments of La Paz, Oruro,

FIG. 102. AËRIAL TRAMWAY, CARACOLES, BOLIVIA

This is a portion of the five and one-half mile aërial tramway which transports ore from the Argentine mine (15,600 feet) across a divide (16,000 feet) and down to the mill near Pongo (12,000 feet); note the glaciers on the left.

and Potosí, the region containing most of the people, supplying 90 per cent of the export trade, and purchasing 90 per cent of the imports (Fig. 102).

These recently developed transportation facilities,[2] the flow of foreign capital which accompanied their construction, and the influx of foreign engineers, miners, and business men have been prime fac-

[2] The first railway line, the Antofagasta-Bolivia Railway, reached the plateau at Uyuni in 1889. In 1903 the railway from Lake Titicaca gave the "Alto" La Paz an outlet by way of Mollendo. In 1913 the Bolivia Railway from Uyuni reached Viacha, a connection near La Paz; in the same year the Arica-La Paz line was completed. Though the completed railways gave access to the Pacific, they did not relieve completely the handicaps of high altitudes, barren desert from the coast, and the rugged Western Cordillera. Without coal, oil, local timbers and equipment, and with sterile lands between the railroad and the sea, freight rates must continue high.

tors in the expansion of modern Bolivia. The commerce of the country has increased from a bare $22,000,000 in 1900 to more than $75,000,000. The chief developments, centered in minerals in the highlands, have emphasized more strikingly the major regions of the country—the Andean Mountains and Plateaus, the Yungas, and the Eastern Lowlands.

CHAPTER XVII

THE ANDEAN MOUNTAINS AND PLATEAUS

That part of Bolivia's area embraced within the region of Andean Mountains and Plateaus presents some of the most striking geographic relationships to be found in South America. Perhaps the greater number of these features grow out of its situation as the "roof of the western world," but along with that go the results of a mineral development scarcely paralleled in the continent. These highlands constitute the present-day nation and their influence is reflected on all sides, in the nature of the predominant Indian and his occupations, in the type of commodity produced for shipment beyond the country's borders, and in the past, present and future trend of national history. The lowlands stretching eastward from the mighty mountain mass as yet signify little to Bolivia, except as a potential sphere for future and possibly important development; and to the constant disadvantage of the country, no western margin touching upon the sea gives the highland interior both a chance for through transport and a field for commercial exploitation, as in other Andean states.

The dominance of this region has persisted throughout Bolivian history. Here live and have lived the majority of the people, and here exist the major economic activities. During Inca and Spanish colonial days, the region was of considerable importance because of its command of routes from Peru to the lands about the Rio de la Plata and the Paraná; in addition, it also carried on much trade with the eastern slopes of the Andes. The international aspect of its important fairs, where gather the natives and the products of Bolivia's neighbors, still shows this character as a center of routes. With respect to communication westward, however, the region today has no such significance, Bolivia's loss of its front on the Pacific having dealt the region a serious blow. This isolation relative to a Pacific outlet promises to place a permanent stamp of backwardness upon the bulk of the population, already on the downward road because of

its early oppression by *Conquistadores*, difficult trying climate, widespread use of coca leaves, overindulgence in alcoholic beverages, and a general lack of constructiveness by and confidence in the government. Foreign development of regional resources has contributed little or nothing to the status of the average native.

By far the greater part of the population lives in the northern portion of the region, where fairly large areas—as about the lower end of Lake Titicaca—have more than 125 people to the square mile. In general, however, the Andean Mountains and Plateaus of Bolivia have a sparse population, the major agricultural and mining district holding between 10 and 30 persons per square mile, while the bleak salt plains southwest of Lake Poopó are essentially empty of permanent settlements.

The difficulties of transportation and the paucity of commodities to form a basis of large-scale exchange have limited the development of considerable centers of population. La Paz, which far overshadows other cities of Bolivia, has a population of some 110,000, much of which has gathered in consequence of the city's rôle as the actual seat of government, although Sucre is nominally the Bolivian capital. As the entrepôt for most of the country, it serves in an important way. No other town in the region has more than 35,000 people, Oruro, Potosí, and Sucre each holding about 30,000. Oruro, lying in the central portion of the area, has made rapid strides as a result of its rôle as commercial center for the tin-mining district. Potosí possesses a long history as a world-famed mining center for the Cerro de Potosí district. Sucre depends chiefly upon governmental activities for its rather unprogressive existence. La Paz, Oruro, Potosí, and Sucre lie at elevations of 12,000, 12,100, 9,340, and 13,600 feet respectively, so that to the problems of provisioning is added that of keeping warm in a perpetually cool climate in a region notably lacking in fuelstuffs; the native seems to adjust himself to the discomfort by developing a stolid indifference.

An outstanding fact about the region's population is the high proportion of pure Indians—approximately one-half of the total. In most respects, these stand at the bottom of the scale in Bolivia. Above them come the *cholos*, or mestizos; a much more progressive group and the possible salvation of Bolivia. But the *cholo* is far separated from the landed and political class, a group of high quality,

but subject to a backward provincialism resulting from the region's isolation. The Indians belong to two main groups—Aymarás and Quichuas, the former living chiefly in the north, the latter and more numerous in the southern areas. From the stony, barren soils of the plateau, they produce a meagre supply of food, while from the fleece of their flocks they make simple but generally satisfactory articles of clothing. Having few wants, they buy little, but encourage commerce by supplying labor. They work in the mines and mills, wearily tread rough stony trails and roads behind a train of llamas burdened with ores, metals, or supplies for the mineral industries, upon which, as in past centuries, the importance of this region now rests. In general, the Aymará is the agriculturist of the region, supplies most of the mining labor, and is the mainstay of the army; the Quichua is less attached to particular industries or occupations and enters all types of service. With respect to raising the level of public interest in matters pertaining to the country as a whole, both are decidedly negative elements.

The *cholos* are pre-eminently the people of the cities or are independent farmers and are Bolivia's nearest approach to a middle class. Less closely attached to and borne down by their environment, they add considerably to any progress Bolivia makes, but neither the *cholo* nor the aristocracy can get away from the shackles of isolation which have so deterred possible Bolivian progress, and which have augmented the control of dominating physical conditions.

PHYSICAL CONDITIONS

In outline, the Andean Mountain and Plateau region consists of two giant mountain ranges separated by a uniformly elevated plateau—the *Altiplano* (Figs. 103 and 104). Practically all of the region lies more than 10,000 feet above sea level, while the peaks and ridges, many crowned with permanent snow and ice, lift their summits well above the zone of crops of any kind and even above summer ranges for the more hardy animals. Mounts Illimani and Illampu rise above the others to heights of 22,570 and 23,900 feet respectively. The plateau floor averages about 12,465 feet in elevation and in general comprises a level to moderately rough surface. Soils vary considerably, but in general they are stony and only moderately productive, those of the salt basin areas of the southwest having no value as

crop lands because of their alkalinity. Numerous mountain spurs break into the plateau margin and within its limits lie two large bodies of water, Lakes Titicaca and Poopó, the former fresh and the latter salt. Titicaca, at an elevation of 12,644 feet, has the distinction of being the highest lake in the world having regular steamer services. Poopó, which receives the overflow of Titicaca by way of the Desaguadero River, is little more than a shallow sheet of salt water having a variable extent.

A chief characteristic of the climate is its discomfort. A plateau region, the land during the day may become fairly warm in the sun despite the altitude, but at night temperatures drop abruptly. During the winter the cold is alleviated somewhat by the aridity, but in general the entire year has rather disagreeable weather. In much of the region, freezing temperatures may be expected throughout the year. The growing season for even the hardier crops is short; because of the frosts, the Indian of the *Altiplano* counts on only one good crop in every four or five seasons. Practically nowhere does annual precipitation exceed 25 inches, but the east receives far more than the saline lands of the southwest; hence the agricultural lands lie along the eastern margin of the region. Fortunately, most of the rain comes during the warm season so that crops in some of the land receive sufficient water, without resort to irrigation.

Under such conditions of soils and climate, vegetation at best presents a meagre aspect, most of the region lying in a zone of scattered bushes and grasses. Owing to the lack of other fuelstuffs and the constant cold, these stunted forms of natural vegetation have great importance in the eyes of the native. The *tola* and the *llareta* are the chief sources; these are supplemented by *taquia*, the carefully gathered and dried dung of llamas. For grazing the major resource is the *ichu* grass. An additional plant of peculiar value is the *totora* reed (*Scirpus riparius*). This occurs abundantly about Lakes Titicaca and Poopó. In addition to affording a haven for myriad water birds, the reed gives the Indian material for the hull and sails of his picturesque reed-boat, known as the *balsa* (Fig. 105).

ECONOMIC ACTIVITIES

Ever since the first Europeans appeared in Bolivia, mining has dominated the economy of the region. Without the extensive min-

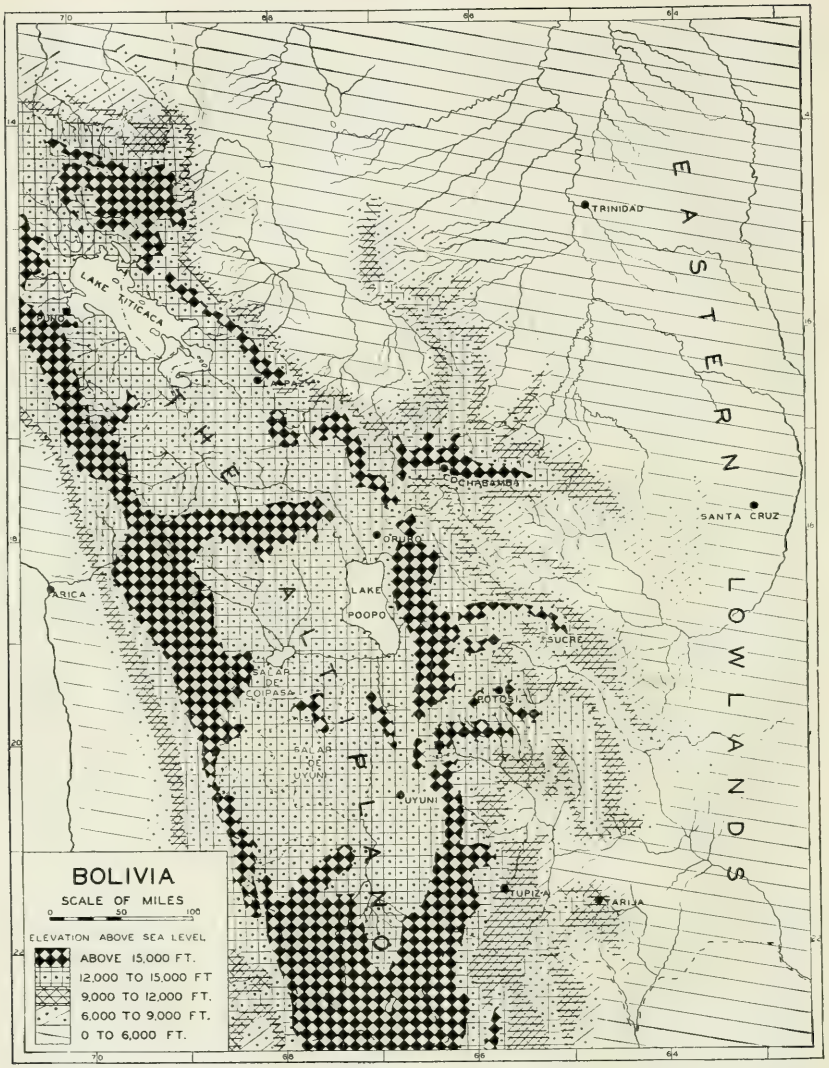

FIG. 103. RELIEF MAP

The Western and Eastern Cordillera inclose the broad *Altiplano*, of which the northeastern part contains a goodly portion of the highland population.

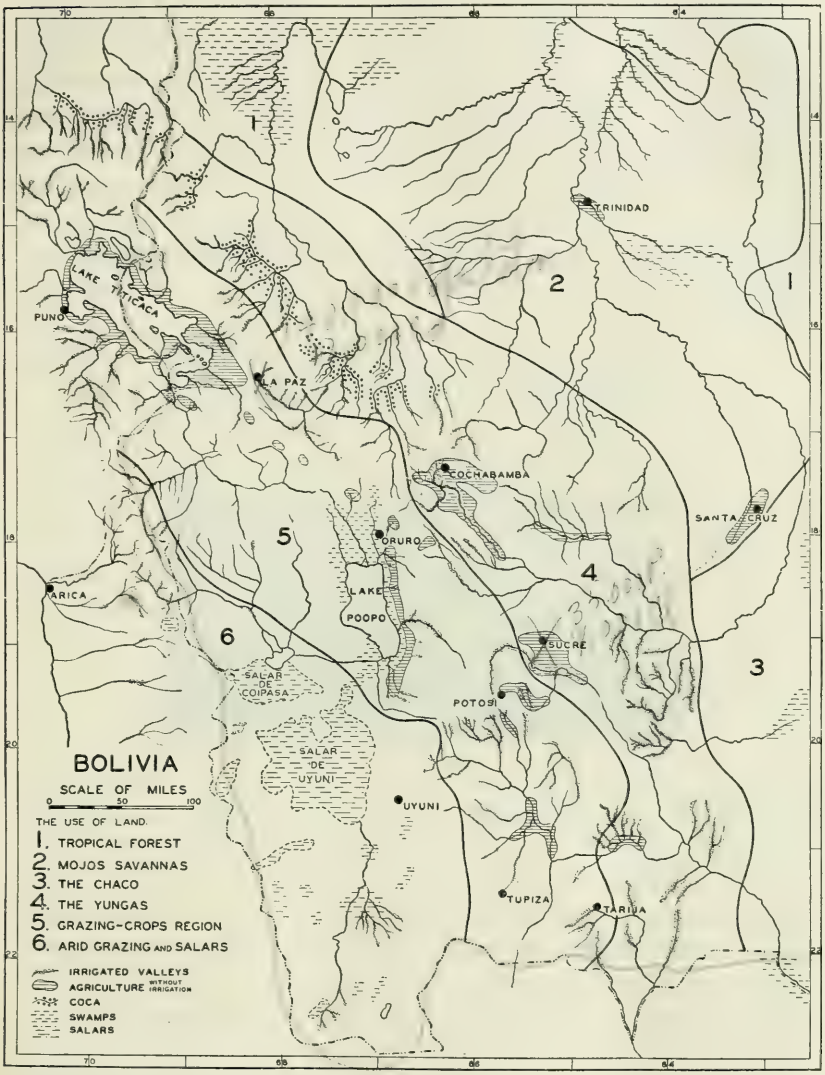

FIG. 104. LAND USE MAP

A surprisingly small part of Bolivia grows crops with or without irrigation; the Yungas and the highland constitute the chief agricultural lands. (Irrigated and farm lands and coca areas after Ogilvie, A. G., "Geography of the Central Andes," *Map of Hispanic America, Publication No. 1,* American Geographical Society, 1922; field notes, 1925.)

eral developments, the region would be one of the poorest in South America. Though farming and grazing support a majority of the people, agriculture can never attain important expansion, because of the inherent poverty of the land as well as the lack of communication with neighboring areas. It is mining which has drawn foreign capital and men to the country to build railways, roads and factories. Most of the large centers of population are situated near mining centers, minerals supply nine-tenths of total exports, and the Bolivian government depends upon them for 20 to 25 per cent of its total revenue.

FIG. 105. A "BALSA" OR REED BOAT, LAKE TITICACA

A primitive, but important, means of transport on Lake Titicaca and Rio Desaguadero; the boat is made of the tall reeds that grow about the margins of the lake tightly bound together with marsh grass ropes; unless dried out frequently the *balsa* becomes waterlogged and sinks.

The Mineral Industries.—The unparalleled degree to which mining dominates Bolivian life has been reached in the face of colossal handicaps for mining development.

Foremost among the problems is that of transportation. On the four railways reaching the plateau, transportation is slow and expensive, since the lines reach incredible heights in crossing the great ranges of the Andes and depend upon imported fuel and supplies. Moreover, while railways tap several mineral districts, many important mines still lie at considerable distances from rail transportation. These mines depend chiefly upon mule teams for bringing in machinery and other heavy equipment, and upon pack trains of llamas or burros for sending out ores and concentrates in sacks.

Second among the major difficulties is the lack of local fuels. The plateau and the mountain country yield neither coal nor oil, and the cost of transportation virtually prohibits the importation of these commodities. Some recourse is had to *tola, llareta,* and *taquia,* but they are not especially suited to industrial requirements. Water-power developments are under way, but the supplying of such power to all the industry is a matter of the distant future. On the other hand, a potentially rich oil supply in the eastern plains may aid the industry, although in this case too, there remains the question of transport to the highland. At present, imported fuel-oil is the most practicable solution of the fuel problem.

A third handicap concerns labor, which though not particularly scarce, consists almost entirely of Indians and *cholos,* adapted to the rigorous living conditions of the mines at elevations of from 13,000 to 18,000 feet. This native labor, although fairly cheap, has a low efficiency and is not sufficient to meet the demands. Foremen and engineers must come entirely from foreign sources, because few Bolivians are able to take charge of active mining operations.

When to these tremendous difficulties are added a frequently inadequate water supply for power and concentration plants and the need for bringing in structural timbers, machinery, mules, feed for the animals, and even food for the people, it is evident that mining in Bolivia is no easy task. Nevertheless, the isolated mountain recesses of Bolivia have and will continue, for some time, to pour forth the chief currents of export trade.

For three and a half centuries, gold and silver, easily accessible but extracted and conveyed laboriously to the sea by Spaniard and Indian, were the leading mineral products. From the middle of the sixteenth to the middle of the nineteenth century, Bolivia contributed gold to the world's coffers at the rate of almost a million dollars per year. With the exhaustion of the richer placer and vein mines, the influx of foreign capital, improved communication, modern mining machines and tools, and increasing demands for industrial minerals in the world's chief manufacturing regions, both gold and silver have given way largely to tin, copper, bismuth, and a number of other ores; all were of little consequence less than fifty years ago, but today these dominate (Fig. 106).

Tin.—Conditions in the tin industry constitute an accurate guide

to the status of Bolivia as a whole. Economic activities throughout the country reflect the advances and reverses in this commodity as regulated by world price and demand. Although total output did

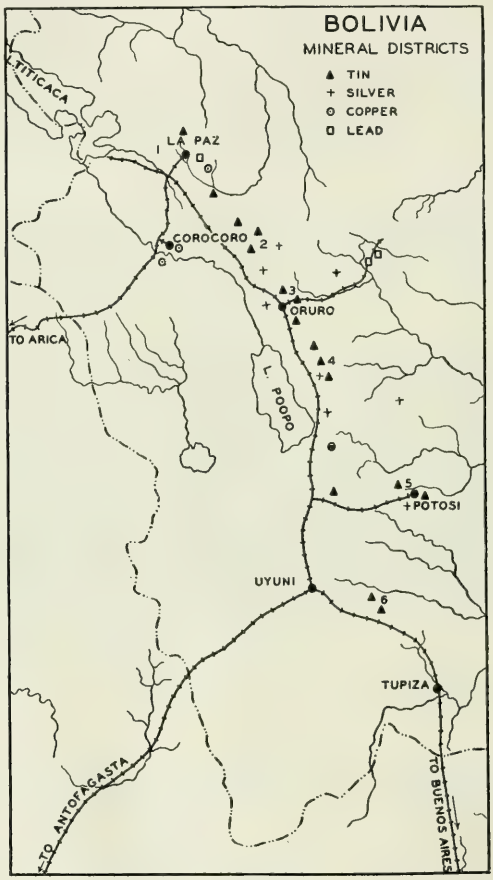

Fig. 106

Most of the mineral districts of Bolivia lie in the Eastern Cordillera, some distance to the east of the Antofagasta-Bolivia Railway.

not reach 5,000 tons until 1897, today Bolivian tin mines account for almost one-fourth of the world's production. Factors bringing about this rapid rise include a slight decline in the output of the rich placer deposits of the Malay Peninsula, the leading producer, and a marked increase in world consumption.

Deposits of tin are widely distributed throughout the eastern range of mountains from north of La Paz to the southern portion of the department of Potosí. The principal fields, however, lie (1) in the Cordillera de las Tres Cruces or Quimsacruz in the department of La Paz, (2) in the triangle formed by Oruro, Avicaya, and Uncia, (3) in the vicinity of the city of Potosí, and (4) in the province of Sur Chichas. A few isolated fields are also found in other departments of the republic.

In contrast to the alluvial deposits of the Netherlands East Indies and the Malay Peninsula, Bolivian tin comes largely from lodes. In general, the solid rock, the resistant lode matter, the lay of the lodes, and the associated minerals make the mining both difficult and expensive in comparison to the simple methods used in producing placer tin in the Middle East.

Bolivian tin is produced for export only, none being utilized in the country. The mineral moves chiefly in the form of tin concentrates, or *barilla*, which average from 55 to 70 per cent tin. Mechanical concentration increases the mineral content of ores for shipment, but rich ores, hand-picked by the cheap labor of women and children, are exported without treatment. The cost of fuel, labor, power, and imported machines, and the complex nature of many of the ores, prevent smelting and refining in Bolivia.

The Bolivian tin industry trends upward. Although primitive pack-animal or mule-cart transportation as well as crude methods of mining and concentration prevail in many mineral districts, rapid improvement in both lines characterizes the tin industry as a whole at the present time. Railways, automobiles, and even aërial tramways replace the llama and the mule in almost inaccessible areas, while modern mining machinery and huge concentrating mills, tucked away in isolated recesses or perched high on the bold face of a mountain, turn out tin for the export trade. The known reserves, sufficient to last a half-century or more, may be added to by the discovery of new deposits, for prospecting has been so difficult at high altitudes that much of the mineralized belt has not been explored systematically. The industry continues to expand with activity at the leading mines and with the working of old dumps and small deposits. Yet under present conditions it seems that the output will not increase greatly from now on, but the present production can be maintained for many

years. With the decline of the rich deposits of the Netherlands East Indies and the Malay Peninsula, expected in the next decade or two, Bolivia will assume a more important position as a producer of tin, a mineral which will continue to hold the dominating position in Bolivian exports (Fig. 107).

Silver.—Silver, long the chief basis of the mining industry of Bolivia, was replaced by tin soon after 1900. World-wide drops in price as a result of new fields being opened in Australia and the United States and the adoption of a gold basis by leading nations led to

Fig. 107. Tin Concentrating Mill, Pongo

A steep slope offers a good site for a concentrating mill, where the separation of the tin from the crushed ore is accomplished by a simple mechanical process with water and the crushed ore moving slowly over shaking tables, one after the other in each level of the mill. This mill lies above the zone of good pasture and crops.

the decline. Scores of mines that had been worked since colonial times were abandoned or began to produce other minerals. Nevertheless, silver still accounts for almost 10 per cent of Bolivia's exports.

Chiefly concentrated or hand-picked ores are exported. Most of the silver produced today, except in very few cases, is incident to tin mining. The total output, therefore, depends largely on activities in other industries in spite of the fact that the eastern mountains of Bolivia in the departments of Cochabamba, Oruro, and Potosí, names as closely associated with the history of silver mining as are those of Guanajuato and San Luis Potosí in Mexico, hold some of the most famous silver mines in all the world. Many of the rich abandoned

silver properties lie idle and await the time of increased demand and higher prices to give this precious metal a more prominent place in the trade of Bolivia.

Copper.—Like tin, copper in Bolivia is largely a development of the twentieth century, and particularly of (1) the World War when demand reached unprecedented levels and (2) the construction of the Arica-La Paz Railway, which taps the chief copper district.

Although cupriferous deposits are widely distributed in both the main ranges of the Andes, nine-tenths of the output comes from the Corocoro district, owing to superior transportation facilities afforded by a branch of the Arica-La Paz Railway and to the existence of quantities of native copper, a combination like that in the Lake Superior region of the United States. Native copper occurs there in the form of powder, plates, or nodules in beds of reddish sandstone, and Bolivia owes its position as a copper exporter to the ease with which this copper can be produced and shipped. The decline in recent years marks the exhaustion of some of the richer beds at this place. Small quantities of copper come also from plants of other regions that treat it as a by-product.

Large deposits of copper exist in Oruro, Potosí, and Chuquisaca, but many promising claims are held unworked. Some lie long distances from rail transportation; all of them lack a fuel supply for smelting; the low-grade ores cannot be exported with profit; and since no sulphuric acid is produced in the country, lixiviation is greatly restricted. Under present conditions the importation of fuel, machinery, and supplies, smelting the ores cannot be carried on profitably. While the future of Bolivia as a producer of copper depends on these deposits, a profitable exploitation of these ore bodies on an extensive scale must await a marked increase in the world demand, the exhaustion of the huge reserves of Chile, the United States, and other countries, and a decided increase in the price of copper.

Lead.—Among formerly minor minerals, lead has risen to importance in the last decade. Owing to high prices, in the two years 1923 to 1925, production jumped from some 10,000 tons to almost 40,000 tons and a number of new developments were opened. Whereas earlier all Bolivian lead came from Tarija, near the Argentine frontier, today large quantities come from various other sections. Several mines produce considerable quantities of hand-broken and hand-

picked ore averaging 75 per cent lead and carrying from 30 to 70 ounces of silver per ton.

Fluctuating widely in production as prices rise or fall are a number of additional minerals, the principal of which are zinc, antimony, bismuth, and tungsten. Rich deposits of all these occur in Bolivia, but other parts of the world dominate output because of easier conditions of working.

Agriculture.—Most of Bolivia's population is engaged in agriculture, yet foodstuffs compose a large part of the country's purchases

FIG. 108. CROPS ON THE LEVEL "ALTIPLANO"

On the right stands a patch of *quinoa*, on the left rows of potatoes; on the extreme left a patch of barley; in the foreground are clumps of *ichu* grass so valuable for forage and fuel. As soon as the sun peeps over the snowy crest of the Eastern Cordillera, the shivering Indians crawl out of the damp adobe hut and stand or squat on the sunny side of the hut, for they have no fires for heat.

abroad. The farmer may labor diligently, but his soil is niggardly and his tools inefficient; he plows with a crooked stick, having a point made of steel; other agricultural processes are in keeping (Fig. 108). The only surplus commodity is wool. Otherwise the region looks first to the Yungas and the Eastern Plains and then to its neighbors as well as extra-continental sources in order to feed its 2,800,000 people.

In some ways, agriculture has retrogressed since the days of the Incas. European and other foreign interests have paid little attention to agriculture, only the promise of riches in the mines luring them to

Bolivia. Moreover, the average Indian farmer displays a stubborn conservatism and sticks tenaciously to the customs of his ancestors, a condition not easily remedied in view of general illiteracy, many Indian groups, and isolated communities.

The rigorous climate of the *Altiplano* restricts agriculture to the cultivation of potatoes, barley, and *quinoa* and the grazing of sheep, llamas, alpacas, and a few cattle.

Crops.—The potato is the staff of life for the native. Though not so nutritious as the cereals of warmer lands, it endures the low tem-

FIG. 109. BARLEY ON THE "ALTIPLANO"

Important for food and forage barley does better on the *Altiplano* than any other cereal; the snow-capped Cordilleras in the east supply water for irrigation; the author is in the field.

peratures, gives a fairly good yield per acre on stony soils, and supplies the starch food so vital to life in this almost fuelless cold region. Enduring some frost and maturing where most crops fail, it grows in sheltered places to as high as 14,500 feet above sea level. Numerous varieties are recognized by the farmer—184 by the scientist—but most of them are small, rough and fine-textured. Much of the yield goes into *chuno*, made by drying in the sun and wind, freezing on the ground at night, soaking in water for two months until the tubers become soft, and then dried again. Thus prepared, they will keep for years, tiding the population over a bad crop year.

Barley, too, occupies a large part of the land under tillage because of its ability to resist low temperatures, frost dangers, lack of sunshine, and stony piedmont soils. It grows at altitudes up to 14,000 feet.

Most of the crop is cut green for want of ripening sunshine (Fig. 109). This cereal and *quinoa* [1] round out the list of the three crops on which agriculture concentrates in the *Altiplano*.

Grazing.—The pastoral industries show as unprogressive a state as farming. An improvement in breeds would bring about a real move towards progress in the region, but grazing so far has failed to gain the attention it needs.

Of an old, degenerated, merino breed, sheep graze throughout highland Bolivia. Flocks varying in size from a few to several thousand contain sheep of many colors, from black to white. Not only in their lack of attention to breeding, but even in shearing the native refuses to adopt modern methods, preferring the use of a sharpened piece of glass or tin to that of shears.

Of greater significance to the Indian is the llama, a handsome, docile animal that finds a place among the herds of every family. It is grazed in large numbers in the region, and, being indigenous to the land, finds conditions suitable and requires little care. Without the llama as a beast of burden and as a source of wool, fuel, meat, bone, and leather, the highlander would be deprived of a vital resource.

Often herded with sheep and llamas, the alpaca in large numbers supply a wool much superior to those animals. A considerable portion of the wool moving out of this highland region consists of alpaca wool. It is long in fiber and fine in texture and from jet black to pure white in color, being adapted for use in very fine high-grade goods; the pelts often serve as high-priced rugs or bedspreads. Alpacas, somewhat smaller than llamas, do not serve as a burden bearer. Only partially domesticated, their chief habitat consists of the cold solitary mountain recesses, where they graze on the short grasses of the high altitudes near the snow line. They require better pasture than llamas; for them pure water is essential, they being unable to go without water as the camel-like llama. Sheared once in two to five years, they yield large fleeces.

Above, the *Altiplano* stretches to the snowfields and the snow-capped peaks, the cold, damp, wind-swept *páramo*, the land of the nomadic herder. Through little frequented lofty valleys, over bold slopes, and into the biting winds off the snowfields, the scantily clad,

[1] See chapter XIV, the Sierra, for a discussion of the importance of this crop in similar areas of Peru and its uses among the Indians.

often barefoot, Indian herder drives his flocks for days in search of forage, often without food save for *quinoa* "pone," cold meat, *chicha* and the stimulating leaves of coca, and without water for a day or more at a time; far from shelter he camps where night overtakes him. In general the *páramo* lands are attached to some vast *hacienda* with headquarters on the *Altiplano*, or *pampas*, though vast high areas are open to all who wander thither.

Though considerable numbers of cattle are raised in the region for local consumption, the total number is small and the animals themselves under-sized. Many are bred primarily for use as draft animals. Though the *ichu* grass furnishes sufficient feed during the rainy season, the dry months limit the possible expansion of herds, the native having enough to do to provide himself with the barest of necessities.

In the entire region and for the grazing industry as a whole, no modern methods exist. Entirely in the hands of the Indians, there is no system of stock breeding. Sheep, llamas, and alpacas are herded together in most areas, giving rise to many crossbreeds with varied colored wools of many grades. Migrating from range to range, pastures are often overgrazed. The animals are sheared from one to five years, mostly with pieces of sharpened stone rather than with modern clippers.

Manufacturing.—It is not surprising that except for the elementary industries which arise in any center of population, the region has practically no manufacturing. Not only is fuel lacking and a large variety of raw materials unavailable, but labor is scarce and unskilled and in general the purchasing power of the Indian, or *cholo*, is exceedingly low. A large part of the wearing apparel needed by the lower classes is the product of domestic industries. With home-made clothing, a few vegetables and some meat, a constant supply of coca, and an occasional bottle of *chicha*, the Indian desires little more and can buy little more.

THE FORECAST

For almost four hundred years the high plateau of Bolivia with its adjacent mountains and valleys has contributed from its mines nearly all the exports of the present republic. It still constitutes the center of the nation's life, since it supplies the exports, holds three-fourths of the population, and consumes the imports. But can this plateau

continue, with its handicaps of remoteness, internal isolation, backward population, lack of mineral fuels, and rigorous climatic conditions, to dominate the nation in all lines of activity?

While the minerals, at present the chief wealth of the nation, will eventually be exhausted, the time when the mining industry will cease to dominate the country is unknown. Several minerals found in relative abundance have been exported only in response to the exceptional needs and prices of war years; they now lie dormant

FIG. 110. A NATIVE INDIAN BAND

Though the instruments consist only of percussion and wind instruments and give forth a weird music, played on the village common on a feast day, they serve to call out young and old dressed in their best for the afternoon dancing, frolicking, and drinking on the village common.

awaiting future demands. Many known or indicated deposits are so inaccessible that their exploitation remains for the time of necessary utilization. In the rugged mountain region, where exploration or even prospecting is so difficult, vast deposits of valuable ores may lie untouched. Greater world demand and improvements in mining technique will make available more and more of the mineral wealth of this highland country. As in the past, the Bolivia of the future, for a century and probably longer, will be a producer of minerals for shipment to the chief manufacturing regions of the world.

The problem of bettering agriculture is a most serious one, but it

offers a means for a general economic uplift for the entire region (Fig. 110). In view of the one-sided interest of capital in the minerals, little foreign assistance seems to be forthcoming. The task devolves upon the native upper classes who have done practically nothing for the lower classes, because of the lack of interest, lack of public funds, and the pathetic ignorance and isolation of the Indians.

From present trends, little can be expected in the way of profound shifts in relationship between mining and agriculture. The region will continue as one of a pronounced deficit in agricultural production and of an even more noteworthy surplus in mineral output. The region will continue to look to oversea areas for food and manufactured wares and to the Yungas for food, coca, and alcoholic beverages.

CHAPTER XVIII

THE YUNGAS[1]

To the east of the Andean Mountains and Plateaus of western Bolivia lies an interesting, but complex, region of deep valleys and high mountain spurs; the Yungas embraces only 12 per cent of the area of the country; it extends from 10,500 or 10,000 feet elevation on the cold bold slopes of the Eastern Cordillera to arid Chaco, to broad savanna and to dense tropical forests in true tropical climes near 2,000 feet elevation. But it possesses within narrow confines some of the most densely settled areas and highly developed districts of Bolivia. Though it embraces physical conditions similar in some respects to those of the bleak highlands to the west and the tropical lowlands to the east, diverse physical conditions, contrasting ethnic groups, and uniform economic responses within lend unity to the Yungas as a region and strikingly set it off from different bordering lands.

The change from bleak dry *Altiplano* and windy snowy passes in the Eastern Cordillera to the narrow, deep, cloud-filled valleys even at 9,000 to 10,000 feet is strikingly sudden; from desert shrubs and alpine forms to grass-carpeted spurs, quilt-like, crop-clothed slopes, forest-bordered streams, and vernal valley floors; from plateau city and mountain mining camp to self-sufficient, isolated, agricultural valleys. In the lower portion of the region eastward facing agricultural lands of sedentary folk change rapidly to lowland forest, savanna, and Chaco, inhabited in large part by forest Indian and semi-nomadic tribes. A climatic, vegetation, and insect barrier effectively separates Yungas and Eastern Lowland. It checked the advance of Inca power and has confined foreign influence largely to the highland.

Thus walled in between high Cordillera and dense tropical forests and broad empty spaces of Chaco, the Yungas is extremely remote

[1] The term "Yungas" in this chapter is being used in the sense of the deep valleys and ridges of the eastern slopes of the Cordillera system, by some authors called, from a geographical standpoint, the Yungas, and not in the narrower use of the term to apply locally to the Yungas of Inquisivi and La Paz.

and isolated. Each ribbon-like settlement in a valley is cut off from near-by neighbors by high mountain walls across which zigzag few easily negotiated trails. Separated from consuming centers to the east by thousands of miles having meagre transport facilities, Yungas contacts are dominantly with the highlands to the west. But only two railways pierce the Yungas from that direction and only one

FIG. 111. CHICKENS TO MARKET

An Indian of the Yungas on the road to market, with a horse-back of chickens, in one of the mining camps of the Cordillera at 16,000 feet above the sea.

modern highway; yet they have not created land booms or facilitated agriculture materially. Contacts are made chiefly over rocky, zigzag, mule trails through high cold passes. By primitive means of transport the valley folk dispose of what commodities their highland neighbors can consume (Fig. 111).

The valleys and steep slopes of the Yungas are inhabited by sedentary folk largely of Indian and mestizo blood, who are little handicapped by tropical plagues of the lowlands and who escape the bare

existence of struggling highland Indian. These folk, compared with others in Bolivia, are fairly well advanced; they have developed the most densely settled groups of population of Bolivia. Densely populated lands lie around Tupiza, Tarija, Sucre, Cochabamba, and in the headwaters of the Rio Beni. These concentrations have resulted chiefly from more auspicious physical conditions for producing the necessaries of life.

PHYSICAL CONDITIONS

Few areas of South America exhibit in close juxtaposition such contrasting conditions of relief, soil, climate, and vegetation. In much of the region one may descend in a few hours by steep, winding, treacherous trails from penetrating cold, struggling highland Indian with his thick-walled hut, cultivated patch of potatoes and *quinoa* and wandering flocks of llamas and sheep to sweltering heat, enervating diseases and insects, and to nomadic forest and Chaco Indians fed by exuberant nature and sheltered from the sun and the rain by pole-thatched huts.

Rugged in the extreme, the relief of the region presents few conditions, as contrasted with the level fertile Pampa of Argentina, auspicious to settlement and development. High mountain spurs separate in the upper portion of the region mile-deep canyons, where mule trails cling to precipitous slopes or repeatedly cross rushing streams, and in the lower portion somewhat broader waste-filled valley floors, where the chief farm lands are. For the region as a whole, little level land exists, but a few flat-floored valley basins cover considerable areas. Many bare mountain walls support no soils. On the slopes soils vary from thin gray soils in patches in the drier portions to deep brown and red clay soils in more moist areas and on igneous rocks and red shales. These heavy red clay soils resist erosion remarkably even on steep slopes. Everywhere small and large alluvial fans and valley floors afford soils from almost pure gray gravels and sands in the upper portion, where streams drop their heaviest loads, to dark fine silts and clay on the lower margin of the fans and in the broader valleys below.

While the Yungas stretches through nearly 10 degrees of latitude, the great diversity of climatic conditions result as much from contrasted relief and exposure as from latitudinal extent and migrations

of the vertical rays of the sun. Relief, exposure and migration of the rays of the sun produce violent contrasts of temperatures and precipitations within short distances.

Well within the tropics temperatures vary chiefly with altitude and slopes. In the lower margin of the Yungas high temperatures prevail; summer temperatures range from 77° F to 95° F and winter temperatures vary between 56° F and 72° F; this region is prevailingly sunny. Intermediate elevations have vernal conditions,

Fig. 112. An Indian Village Above Pongo

Grasses and low bushes partially clothe the slopes in the upper border of the Yungas; patches of potatoes and *quinoa* in the foreground, near the upper limit of cultivation.

no unpleasant extremes of either heat or cold. The proportion of sunny days is greater than that of cloudy ones. Higher up, from 8,500 to 10,000 feet temperatures are lower, typical stations having mean annual temperatures of 64° F or lower, in December 70° F to 77° F and in June or July 35° F or below. Prevailingly cloudy and moist, this zone has penetrating temperatures.

The region receives between 10 and 35 inches of rain annually, although locally exposed slopes may get more and broad deep sheltered valleys may receive less. As much as three-fourths of the precipitation falls in the rainy season from October to May, but local

convectional showers may take place even in the driest months. Four rain zones are well marked: (1) the low hot plains of convectional and heavy rains, (2) dry, sheltered, valley floors of basins in the lee of marginal mountain spurs, (3) the zone of maximum precipitation on exposed slopes 6,000 to 8,500 feet elevation, and (4) higher up a light and varying zone of lighter rains.

Consequent upon relief, soils, and climatic conditions, vegetation exhibits similar striking contrasts. In the wet, hot valleys forest growth is dense and undergrowth luxuriant; a variety of species abounds. On the valley floors and tributary fans shrub growths expand into forest bands along the water courses. In the deeper drier valleys and on coarse alluvium xerophytic vegetation, including cacti and associated species, dominate. On intermediate slopes within the cloudy rain zone open stands of trees grow by species. Tongues of trees extend up deep valleys, shady ravines, and moist slopes to the limit of the Yungas. The timber line varies vertically more than 2,000 feet in the Yungas owing to conditions of relief, soil, ground water, sunshine, and winds. The major forest zone of the lower plains is separated from that of the cloudy rainy slopes by drier arborescent types and grasses. Also above 8,500 feet grass-covered slopes dominate the landscape (Fig. 112). Slopes in much of the region that receive the noon and afternoon sun for a large part of the year are covered with grasses, shady nooks with trees; change from trees to grasses in many places is so sharply defined that the transition seems to be the artificial edge of cut-over lands.

OCCUPATIONS

Though a variety of physical conditions exist throughout the Yungas, the population pursues only a few lines of major activity: tilling the soil, tending flocks and herds, exploitation of meagre forest resources, the primary preparation of agricultural products, and the marketing of these in the highlands.

Yungas Agriculture.—The marked compression of relief features, soil types, climatic zones and plant associations provide in the Yungas favorable conditions on restricted scales for almost the whole list of temperate and tropical agricultural products. These same features prohibit the use of much of the land; only a fraction of the area can ever be used. The agricultural lands of the Yungas comprise two

distinct types: (1) the lower slopes of deep red soils and the broad waste-filled, fertile, valley soils, where among a great variety of agricultural products coca, corn, barley, sugar cane, and cacao, in the products they supply for trade, occupy an important place commercially, and coffee, a variety of fruits, and vegetables constitute subsistence products, (2) high pastures where graze llamas, alpacas, and sheep, and where Indians grow in patches on mountain slopes potatoes, barley, and *quinoa* and in the narrow upper valleys corn, barley, and pasture.

Landowner, tenant, and independent farmer give chief attention to the production of commodities that provide articles which can stand the cost of transport on mule or human porter to the chief markets—the mining camps and the towns of the bleak highlands. Little interchange takes place between neighboring valleys, since all produce like commodities.

Chiefly Commercial Crops.—Most typical of the Yungas, the coca plant (*Erythroxylon coca*) finds favorable physical conditions, meets the exacting requirements for shipment, enjoys a large local market, and is widely cultivated; it supplies the basis for the most lucrative business of the region as a whole, though the chief coca terraces are in the northern portion of the region, the moister section.

The coca plant grows as a shrub, attaining a height of 5 to 10 feet, though most plants are pruned to 2 or 3 feet as the smaller bushes yield more tender leaves. The young plants, produced from seed under a shelter of straw or banana leaves, are transplanted when a year old to terraces about a foot wide, four or six plants to a hill, and are irrigated. Carefully cultivated, the bushes may be picked at the end of 2 years. Then they yield in four pickings from 1 to 2 tons of leaves per year for a period of 12 to 18 years.

Coca does best on steep slopes of well-drained heavy, red clay soils from 2,500 to 6,000 feet elevation, with considerable rain or irrigation. The plant for a large yield of tender leaves requires moist air and fairly high temperatures, 65° to 80° F, not too much direct sunshine, often cut off during the heat of the day by clouds and mists drifting up the valleys (Fig. 113).

After being picked, the leaves are dried in the sun on earthen or slate floors, pressed into bales of 25 to 50 pounds, and in this concentrated form at 12 to 20 cents a pound, packed on mules or by men to

the highland markets. A part of the personal equipment of every Indian more than six or seven years old in these regions, coca leaves when chewed with a little lime or ashes of *quinoa* precipitate cocaine and relieve for the weary Indian hunger, cold, thirst, and fatigue, by deadening the nerves and other sensibilities. Its use enables the Indian to go without food for a considerable time, to work long hours without rest in the high mines or to tread through the day and part

FIG. 113. HARVESTING COCA IN THE YUNGAS

The Indians labor hard to terrace the slopes and carefully till and pick their chief crop, one that stupefies their sensibilities; bananas, cassava, corn, and other crops supply food. (*Courtesy of the Bureau of Foreign and Domestic Commerce.*)

of the night the dreary, rough trails in the rear of a llama train. Also it gives rise to the "fog" that envelops the mind and face of the stupid, degenerating Indian. From a small part of the crop is extracted in many small factories the alkaloids that move to the northern hemisphere in the form of white cakes to be used as the basis for the anesthetic cocaine. Packs of leaves constituting one of the few Yungas commodities that penetrate distant marts are also exported for this purpose.

Corn in all parts of the Yungas, except the thin soil areas and high cold districts, clings to the steep slopes and spreads out onto the

alluvial soils of the larger valleys. Planted at intervals of 6 to 10 inches in rows 3 to 4 feet apart, in contrast to coca it receives little attention; seldom plowed, it may be hoed once or twice during the season. In spite of inferior seed and poor methods of tillage, it grows to a good height and produces kernels of good quality owing to fertile soil, favorable precipitation and much sunshine. It fits well into the agricultural economy of the region. About two-thirds of the entire crop goes for the manufacture of *chicha*, smaller quantities being used

FIG. 114. THE VILLAGE OF QUIME

A typical Yungas village located in a deep "V"-shaped valley with corn and other crops carpeting the adjacent slopes.

for feed, and some for breadstuffs; some fields are grazed in the drier valleys. In addition to a widespread use in the Yungas, the concentrated product, *chicha*, a muddy, yellowish drink, the taste of bad cider, like its first cousin—"corn likker" of the Kentucky mountains—will stand the cost of transport to remote and isolated Andean recesses and well pay the Indian trader for days of weary travel on zigzag, rocky, muddy, mountain trails (Fig. 114).

Barley, the chief cereal of the high cold and less fertile lands of the Yungas, occupies a large acreage in the lower parts of the region. On poor dry lands where other crops do not thrive so well, it fits into the agricultural economy of the region. Almost the entire yield is converted into beer and alcohol; in dry sections the straw is valuable forage for livestock.

Wheat, one of the leading food crops, is produced in considerable

quantity on a variety of soils and on steep mountain slopes as well as in the valleys. Yields average low as with most other crops. Harvested by hand with a sickle, thrashed by driving oxen over the sheaves on a stone floor, and winnowed in the wind, it is ground in numerous small mills at the base of mountains, where water from a small stream operates a stone burr. Despite widespread culture, the Yungas imports flour.

Sugar, well adapted to fertile alluvial soils, much sunshine, and irrigation where local rains do not suffice, occupies favored positions in valley bottoms and climbs up the lower hot slopes on well-drained heavy, red clay soils. Giving fair yields of cane per acre in spite of poor methods, the fields produce three or four ratoon crops. Like corn it gets little cultivation. The cane ground in small crude crushing mills gives a fair quality sugar whitened by means of mud. As with corn most of the crop converted in small *trapiches* into *aguardiente*—brandy—or alcohol, provides commodities of high value per unit of weight and bulk.

Cacao, grown in the lower, hot, moist margin of the Yungas from 2,000 to 3,200 feet elevation, supplies another commodity adapted to the region. Confined to the heavy but well-drained soils and to the hot humid portions, the cacao trees require little care, once they begin to bear, except for weeding now and then and maintaining drainage ditches. Eight- to ten-year-old trees may bear 1,000 pounds of beans. The beans dried with care and cracked yield the cacao seed which is ground by hand on an incline plane with heavy round stones; then the chocolate, worked into cakes, dried, and sewed in air-tight cowhide bags, moves to all parts of Bolivia. Yungas cacao reaches few foreign markets, because of low quality and transport costs.

Subsistence Products.—In addition to the preceding crops which supply vital commercial commodities, the Yungas produces a wide range of chiefly subsistence articles. Yet small quantities of many of these move to the chief towns within the region and to highland markets.

Coffee, grown up to nearly 6,000 feet, is confined to small patches; no large plantations exist. Trees, planted chiefly as hedges along roads and fields, receive no care; they are neither pruned nor shaded. Natives pick ripe and green berries from an entire branch with one stroke of the hand. Berries of good size, owing to favorable relief,

soil, and climate produce a poor quality coffee with inferior methods of culture and preparation.

A variety of fruits adapted to the Yungas environment is grown in restricted patches up to 6,000 and 7,000 feet elevation. Small vineyards, chiefly irrigated in the drier valleys, yield sweet, small, poor quality grapes, all of which are used for wines. Bananas, tangerines, oranges, chirimoyas, and peaches of fair quality grow in response to favoring physical conditions. Fruit trees receive little or no care; pruning and spraying are unknown. Diseases, insect pests, perishability, meagre transport, and remote markets restrict production.

As with fruit a variety of vegetables do well. They include the potato, yucca, onion, radish, beet, and others. Potatoes increase in importance from the low dry valleys to the cold high mountain slopes where they become the chief crop, being better adapted to the rigorous climatic and soil conditions than any other crop and yielding comparatively high returns per acre.

Animals.—As a whole Yungas agriculture finds small place for animals. In the lower regions, crops cover most of the fertile valley floors and climb high on the slopes, consequently leaving little land for pasture. Also a forest cover in the moister places and xerophytic vegetation on slopes and in stony sheltered valleys, further restrict range lands. Animals consist of draft cattle for use in breaking fields and of mules for pack transportation. Small herds seldom contain more than 200 head. Dairying is little developed, and the meat from the old draft steers is of poor quality. Some goats, pigs, and chickens, "often members of the household," pick up a precarious living. But in general, this is one area in South America where large numbers of animals do not find a significant place in the agricultural economy of the region. However, higher up on sunny slopes, thin or stony soil areas, and above the timber line in the upper portions of the major rain and cloud zone good grasses occupy much of the rough mountain land and graze numerous llamas, sheep, and some alpacas. Whereas in the hot valleys the cultivation of crops comes first, here the care of animals becomes the chief concern of the small Indian settlements. As on the great plateaus to the west, the Indian derives from them the major proportion of his meagre necessaries of life.

Land Tenure and Labor Supply.—Nearly all the land of the Yungas is held in large estates by owners, who reside in La Paz and commit

the management of the estate to a major-domo. Of vast area, containing as much as 750,000 acres in some cases, estates usually extend crosswise to the trend of the valley, though some stretch from the lower part of the region to the upper border. They include all types of land—fertile valley floor, naked mountain wall, high pastures, elevated alluvial fans, steep coca slopes, and lowland and highland forests. Each estate must provide almost year-round employment for many permanent laborers and their large families; even small estates may have as many as 100 to 150 permanent laborers.

For each one of these permanent laborers, whose low one- or two-room mud or stone houses are provided by the estate owner, and who receive wages, food, and clothing for regular work on the plantation throughout the year, each estate may have attached to it as many as twenty *faena*, or free Indians. The labor of these *faena* is free to the planter. They live in adobe or thatched huts on the high hillsides or in the margins of the valley floors. They do not own the land they live on and cultivate in small patches. For the privilege of squatting on the land, the Indians must pay the landowner in work at the rush harvest season, in a portion of the potatoes, coca, or other crops he grows, or in animals he grazes on the high pastures. In some cases the planter receives money, but in general he prefers labor, since in spite of a fairly dense population, labor is actually scarce; one of the chief problems of the Yungas farmer is that of scarcity of labor. Highland Indians are not adapted to the Yungas environment with its subtropical conditions, insects, and diseases. Often these laborers come as far as 50 miles for their due portions of work to the planter. While giving of the toil of their hands, they live with friends on the estate or sleep where nightfall overtakes them. Each laborer, permanent or *faena*, gets a weekly allotment of *aguardiente* or *chicha*.

Though the Yungas has some of the most highly developed agricultural lands in Bolivia, agricultural methods are extremely primitive, except for coca culture. The Indians, left to themselves, farm as in the days of the Incas. The major-domo often has little, if any, idea of better farming than the ignorant laborer. Should the planter desire to improve methods to procure larger returns, many obstacles stand in the way.

The rugged relief, narrow valley fields, the expense of importation, and the ignorant laborer prohibit the use of modern implements.

Moreover, most planters are not anxious to introduce implements that will increase the idle hours of permanent laborers, supported on the plantation, or decrease the number of *faena* attached to each estate. The farmer gets along with the minimum of tools, including a crude wooden plow pointed with steel for scratching the soil, a heavy hoe for chopping weeds and surface cultivation, a machete for clearing out brush and cutting corn and cane, and a sickle for harvesting barley and wheat. Cane presses, flour mills, and *bodegas* have the crudest of machinery (Fig. 115).

Forest Exploitation.—The forest zones on the slopes and the valley strips of trees provide valuable forest products for the Yungas proper,

Fig. 115. A Crude Cane Press

With implements and factory equipment of the crudest types, the Yungas cannot be expected to produce manufactured wares in spite of some favorable conditions; note the rough bony cattle. (*Courtesy of the Bureau of Foreign and Domestic Commerce.*)

as well as for the treeless mountain and plateau to the west. Spanish *cedro* and a few tropical hard woods, cut and sawed by hand, move on the backs of mules to city and high mines for structural timbers, mine props and posts. Yet they do not supply the demand.

In the headwater districts of the tributaries of the Beni cinchona bark (*Cinchona, calisaya, cordifolia,* etc.), stripped from the branches and trunk of the plant, dried, and packed in bundles of about 50 pounds is exported for the production of quinine. Though a forest-gathering industry for the most part, in some sections it is being cultivated. But the inhabitant benefits little from it. The lowly Indian, who toils to produce and prepare the product that breaks the colds and quiets the fever of distant peoples, is too poor to purchase the product of his labors to relieve him of the shaking ague.

Manufacturing.—Aside from the primary preparation of agricultural products, the Yungas has little in the way of factory development. Though silver, gold, tungsten, and other minerals exist in the upper portion of the Yungas, their small exploitation provides little for basic industries. The region lacks iron and coal. On the other hand it possesses forests and much undeveloped water power. Unskilled labor, lack of capital, and meagre transport confine factory development to the fabrication of liquors, coca extract, sugar, flour, and a local supply of handmade tools, furniture, and textiles.

As a whole little expansion or development may be expected in the Yungas for a long time. Paucity of level arable land vitally restricts agriculture. Steep slopes, though of heavy clay soils, erode under years of cultivation, covering fertile valley soils with sand and sediment, and must be abandoned for new strips on the mountainside. Though forest and power resources exist, several factors prohibit manufacturing enterprises on a large scale. Isolation from the major world markets will continue; Yungas commodities cannot bridge the broad expanse of tropical forest, Chaco, or fertile plain to the Atlantic; neither can they bear the brunt of high freight rates over the Andean bulks to the Pacific. Except for a few that may be reached by rail lines or modern highways, Yungas towns and valleys will continue isolated and self-dependent communities; occupations will continue along the lines followed for centuries. A few commodities of high value per unit of bulk and weight will move to outside marts. Nevertheless, expensive and meagre transport to even the adjacent highland market of small buying power deters significant expansion or improvement.

CHAPTER XIX

THE EASTERN LOWLANDS OF BOLIVIA

A succession of abrupt ridges or *cuestas* of limestone and sandstone strata dipping rapidly to the east combine with a transition in tropical heat, precipitation, vegetation, animal life and consequent human adjustments to clearly delimit a border zone between fertile valley of the lower Yungas and broad low plain to the east. The vast lowlands of Bolivia comprise fully two-thirds of the area of the country; but this extensive domain supports a mere fraction of the population of the country and supplies less than 3 per cent of the exports of the nation.[1] Never penetrated by Inca influence, these remote and isolated lowlands have little felt the power and development of Highland Bolivia. Despite centuries of foreign political control, they are still the favorite haunts of tropical insects and animals and for the most part backward forest and Chaco Indians.

Near the western border of the lowlands and almost the geographical center of the country, Santa Cruz de la Sierra, the largest community of the region, with 25,000 inhabitants, vividly illustrates the degree of remoteness and isolation endured by most interior communities. It lies 100 miles from the absolute head of navigation on the tributaries of the Mamoré on the north, 400 miles from navigation on the Paraguay at Puerto Suárez, nearly 500 miles from the rail head in the south at Embarcación, Argentina, and 300 miles by difficult mule trails over successive ranges of the Andes from the railroad at Cochabamba.[2] These points once attained by a traveller from Santa Cruz still leave him 2,000 miles from the mouth of the Amazon and the Rio de la Plata on the east and face to face with the bleak, cold Andean barrier on the west. Within the region communication and transport rely on sluggish meandering streams, between walls of

[1] Politically the lowlands embrace Colonias, El Beni, the northern half of Cochabamba, nearly all of Santa Cruz, the eastern portions of Chuquisaca and Tarija, and the undetermined extent of the disputed Chaco.

[2] East of Cochabamba a hundred miles of treacherous Andean trails bear the significant name of "*Sal Si Puedes*" (pass if you can).

tropical luxuriance and unkept muddy or sandy trails or cart roads. A land without automobiles, it possesses neither highways nor rail lines.

Despite tropical abundance in many portions, the whole region has far less than one person to the square mile. People have gathered only in special places. On the western margin a string of settlements south of Santa Cruz embraces more than half the people. A few settlements have been established along the Pilcomayo and the upper Paraguay. In the forest region of the north families of Indians are grouped in small clearings on the banks of streams or on interstream savanna areas of some large estate. In the remainder of the lowland free forest or Chaco Indian may wander whither he listeth, gathering food from exuberant nature and fighting his enemies,—insects, animals, tropical heat, and diseases.

Dominantly low relief, contrasted with other portions of Bolivia, sparse population of backward Indians, and primarily tropical conditions lend unity to the eastern two-thirds of the country; but differences of relief, drainage, temperatures, amount and distribution of rainfall, vegetation and consequent responses clearly delineate three divisions of the Lowlands of Eastern Bolivia. In the north lie the rainy, hot, chiefly forested low plains crossed by many slow meandering streams, some of which lie uncharted, possibly "Rivers of doubt" undiscovered—a portion of true Amazonia. In the south from the Santa Cruz plains and *cuestas* to the Paraguay stretches nearly 400 miles of dry Chaco country of low relief and without any major drainage channels. Between these two rise the low Santa Cruz plains on the west and the "so-called" Chiquitos Highlands in the central portion, the two being largely separated by the lowland wilderness of the Rio Grande, which all but joins the lowlands of the north and south portions.

THE NORTHERN PLAINS

The northern plains consist of: (1) low, flat terrain, crossed by many sluggish, meandering, brown streams that reflect perfectly the bordering walls of tropical rain-drenched forest; (2) deep forest solitudes, to the white man almost impassable jungles, and to the Indian, who dwells in villages along the river's edge or in solitary huts all but hid by overhanging boughs, the home of wild beasts they hunt for food with bow and arrow, the haunt of snakes and in-

sects that torment and the evil spirits that lurk in hiding for the unwary; (3) forest stretches broken only by a little clearing for corn, cassava, and bananas adjacent to a pole-thatched hut around which play the many unclad children and under which the head of the family dozes away the day, by ill-defined trails frequented only by wandering rubber gatherers, or by remote and isolated interstream savannas supporting a grazing industry of a primitive type; (4) mission lands where *padres* minister to the weary, the sick, and the soul-starved primitive Indian—these are the characteristics of the northern plains of Bolivia, just a bit of greater Amazonia. With little

FIG. 116. ESPERANZA, BOLIVIA

On the many streams of the northern plains of Bolivia rowboats and launches serve as the chief means of transport. (*Courtesy of Dr. Avelino.*)

elevation, low relief, great heat and heavy precipitation throughout the year, and a heavy forest cover, the plains are difficult to traverse. Open trails, few in number, cut 50 to 60 feet wide in the forest seldom get dry enough for heavy bullock-cart transportation. The pack animal of the highlands or the savannas here becomes useless, as he mires down in seemingly bottomless mudholes at frequent intervals. A traveller on entering the lowland forest if bent on overland travel leaves the pack animal behind and takes to foot with human porters, or if bent on traversing the region more hastily takes to a canoe and glides or paddles swiftly down the meandering streams, stopping on some sand bar or sandy bank where night overtakes him. A few large streams have steamboats, infernos where man suffers horrible physical punishments (Fig. 116).

Population and Living Conditions.—Constituting a density of less than one-half person per square mile, the population, in addition to the sedentary and semi-nomadic Indians, embraces foreigners of many types, engaged especially in the rubber industry. Population is spread chiefly along the streams, the chief highways, and on the savannas, where exist the headquarters of the major ranches of the region.

Everywhere primitive conditions of life prevail. Agriculture in the modern sense of the term does not exist. Each Indian hut, village, cattle estate, or rubber gatherer (*seringueiro*) may have a patch of corn, cane, cassava, a few bananas, and other fruits, and possibly some vegetables. Land is seldom tilled, the crops being planted often among standing trees that have been girdled or burned, and allowed to struggle among the weeds till the crop is gathered. Much of this territory can never be farmed as annual rains and floods cover vast areas of low lands; eminences safe from inundation are difficult of access. Products cannot be kept long, so food is often scarce in the face of tropical abundance. Much of the corn grown goes for the manufacture of *chicha*, the common drink of all Bolivia. Cassava is eaten boiled, instead of in flour as in other parts of South America; it also makes an intoxicating drink.[3] For the Indian the simple vegetable diet is supplemented by meat from the animals of the forest or by fish which the Indian, an expert archer, invariably kills with bow and arrow. The *seringueiro*, in addition to killing game, may buy dried beef brought down from the cattle plains.

The native Indian and the *seringueiro* require little in the way of shelter and clothing (Fig. 117). A simple pole-palm thatched hut without sides serves as shelter from the scorching rays of the sun and the pelting rains. The bark-woven shirt and trousers worn by many of the inhabitants are well adapted to the enervating heat of the day, but afford no protection at night from the voracious swarms of insects that suck and sting, making peaceful sleep impossible. Few huts or homes are screened to keep out insects; neither do the people use mosquito netting.

The native population suffers at the ravages of insect pests and

[3] The Indian women dig quantities of cassava root, peel and cook it thoroughly, after which part of it is chewed and expectorated into an earthen jar to which is added mashed cassava and water; soon fermentation sets in and the yellowish-green liquid quickly intoxicates all who imbibe.

tropical diseases. Inhabitants are almost helpless in the face of these scourges. In fact it becomes a doubted question whether white man with all his skill and modern science can develop over vast areas of the humid lowland tropics comfortable places in which to live. Malaria is endemic especially above numerous rapids in the many streams and in large areas subject to inundation. Natives use little

FIG. 117. INDIANS ON THE BANKS OF THE RIO GRANDE

Uncivilized Indians on the banks of the Rio Grande at the crossing of the main trail leading from Santa Cruz southward to Embarcación, Argentina (the large logs are of balsa wood and are used by the Indians in swimming the river). Compare the Indians in this picture with those in Figs. 3 and 101. (*Courtesy of Kirtley F. Mather.*)

quinine; most people have malaria. Hookworm debilitates most of the population. Digestive disorders, owing to defective or inadequate nutrition or to polluted drinking water, sap the strength of many. Little care is taken to insure a pure water supply, the Indian drinking water wherever he finds it. Furthermore, the inhabitant, though constantly exposed to the sting of poisonous and other insects and the bite of many venomous snakes, including the fer-de-lance and bushmaster, seldom possesses any fundamental prophylactic. Truly as often as not the helpless forest dweller is at the mercy of insect and disease.[4]

[4] "At night vampire bats came out in hordes; they attacked everything from human beings down; even the few miserable pigs kept by the Indians were severely bitten and kept up a continuous squealing as the bloodthirsty creatures settled on them, usually at the base of the ears, and began their painful operations. The worst sufferers by far, however, were the mules. As soon as the sun set, our peons brought the animals to the corral and strapped canvas covers over them; this precaution, however, was of little avail, for the bats attacked all exposed parts, causing the mules to kick and roll with the result that their covers were soon torn off. We went out frequently to watch these

Yet not all native life handicaps man's existence. In the twilight of the evening panther and jaguar with the low rumble of their noises break the silence of the closing day. Small short-pronged deer, fleeting in and out among the trees, droves of wild pigs (peccaries of the tropics) foraging on succulent root or stem, small and large monkeys of all colors chattering and swinging from branch to branch, glossy black and crimson-comb turkeys hid in the underbrush or perched high on hanging bough—all succumb to the deftly aimed arrow of the Indian archer and thus appease the pangs of hunger.

Forest Industries.—Dominantly a forested country, arborescent forms include a great variety of trees. Two major groups may be distinguished: (1) the lower parts of the land, subject to floods, grow many bamboo, large herbaceous plants with banana-like leaves, many palms, soft woods, such as palo santo, ambaiba (*Cecropia sp.*), and pelato (*Sapium sp.*), hard woods, such as guiabato (*Calycophyllum spruceanum*), bi grande (*Genipa americana*) and tajeiro (*Tecoma sp.*), and the monarch of the forest, the *ceiba*, whose crown towers well above other trees. (2) On the *tierra firme*, higher and fairly well-drained soils are the Brazil-nut tree (*Bertholletia excelsa*), Spanish *cedro*, the rubber tree (*Hevea brasiliensis*), and many others. Like the *ceiba* in the low reaches, the Brazil-nut tree on the *tierra firme* towers above all adjacent trees. Despite the great wealth of hard and soft woods, the lumber resources scarcely have been touched.

obnoxious creatures at work; after circling above their prospective victim a few times, they dropped suddenly, usually upon the neck or flanks, and at once began to bite and suck, making a grating sound with the teeth all the while. They paid no attention to us, although we stood but a few feet away, but clung with folded wings to their victim, perfectly motionless and in an upright position; if we moved they uttered a few squeaks, but made no attempt to fly until we reached for them and came to within a few inches, when they reluctantly fluttered up but almost immediately settled on the other side of the animal. Desiring specimens of them for our collection, we went one night to the corral armed with a butterfly net and, approaching one of the mules on whose back were a dozen or more bats, made a hurried sweep with the net; as the large, white bag of netting scraped the back of the nervous animal he sank to his knees with a groan of despair, wondering, no doubt, what new monster had swooped down upon him to add fresh suffering to his already unbearable existence. In the morning the mules were in a pathetic condition; blood continued to flow from the wounds made by the bats' sharp teeth, so that the ground was red, and the animals were covered from head to foot. It was always necessary to take them to the river and wash them, and then disinfect the numerous punctures; if this is not done flies attack the sore spots, infesting them with their larvæ, and the animals die of blood-poisoning. After three nights we were compelled to start the mules back to Cochabamba, as they were on the verge of exhaustion." From "Across the Bolivian Highlands from Cochabamba to the Chaparé," Leo E. Miller, *Geographical Review*, Volume IV (1917), p. 282.

High freight rates owing to meagre transport facilities have prevented the development of even a Brazil-nut gathering industry in this part of the tropical forest. As yet these forests have been exploited for only one product—rubber.

The rubber which flows from the wounds in the trees of the forest of this region is the chief product of the entire eastern lowlands. Though the first rubber was taken out of the Mamoré region in 1864, the development of the industry dates from the eighties. At that time many thought that rubber was destined to be the principal product of Bolivia, and the Beni and Madre de Dios districts were heralded as being El Dorados for the growth and exploitation of this product. As a result large sums were invested in the field in anticipation of handsome profits.

The industry, although hindered from the start by inadequate labor, the unhealthful conditions of the country, and a general lack of transportation facilities, expanded rapidly. Under the active stimulus of a marked increase in world consumption and a rapid rise in the price of rubber the exports mounted from less than 1,000,000 pounds in 1890 to nearly 13,000,000 pounds in 1917. Many conditions encouraged growth: the opening up of new districts; the completion of the Madeira-Mamoré Railway provided a vital connecting link in the water outlet of lowland Bolivia; and the mounting price of rubber (it reached $2.92 per pound in 1911) gave during the boom years exceptionally profitable returns which stimulated every means of increasing the output of this forest product. Following 1917 diminishing profits on the Bolivian output could not keep up the production in the face of keen competition with plantation rubber from the Malay Region. Moreover, many of the trees of the new districts opened in the early years of the present century had reached their maximum flow and were on the decline. Consequently the exports dropped one-half from 1917 to 1921. Plantation rubber snatched from Bolivia the market for its second export. Before the World War rubber constituted 24 per cent of the value of the total export trade, whereas in recent years it has contributed a bare 3 per cent (Fig. 118).

While the tropical lowlands of Bolivia contain numerous fine untapped *Hevea* or uncut *caucho* trees, the region lacks capital, men, transportation facilities, and supplies. Future production depends not so much on resources as upon the trend of market prices, but the

high returns of the boom days before the war probably will never return. With the present level of prices Bolivian wild-rubber producers cannot hope to compete with plantation rubber. Although they may continue to ship a few million pounds per year until the more accessible trees have been cut or have run out, rubber cannot contribute much to the development of the country.

Grazing.—Though the vegetal growth of the northern plains is chiefly of the forest type, here and there stretch broad natural savannas, and adjacent to all the large rubber-gathering headquarters are

FIG. 118. TRANSPORTATION OF RUBBER

The major resource of the forest section of the northern plains of Bolivia consists of rubber. Wagons used in transporting rubber from the Tohuaman River in eastern Bolivia 25 miles north of Cobija. This is the half way point on the route where the ox teams are turned out to rest and graze. Except for small cleared places planted to grass, the dense tropical forest covers most of the land. (*Courtesy of C. F. Marbut.*)

cleared pasture lands supporting from 50 to 200 head of cattle. The chief areas of savanna include interstream stretches between the Guaporé and Mamoré and the broad Mojos plains between the Mamoré and the Beni. These plains covered with luxuriant grasses of fair quality usually possess plenty of water.

Probably one million head of cattle graze in the northern plains; they consist of the creole breeds and *ganado bravo*, or wild cattle, which run for forest cover when pursued. Many handicaps restrict any major development of the grazing industry. Periodical inundations cover wide expanses on which the herds graze. Lacking salt, the region must import it at great expense by mule back and boat from the arid highlands to the west—Oruro and Uyuni. Hoof and mouth disease, carbuncle, and Texas fever are endemic. Some cattle

are killed by jaguars; others die from bites of poisonous snakes. There is no selection of breeding stock; fenced ranges are unknown. No slaughtering plants exist to handle any of the animals. But the greatest obstacle deterring advance is the lack of a market. The local market is restricted to a few thousand head in the rubber forests. Long difficult trails restrict their movement to the food-starved highland. And the vast plains to the east and south possessing millions of cattle of equal or better grade prevent any marked expansion in the industry in this region for a long indefinite period.

SANTA CRUZ DISTRICT AND THE CHIQUITOS HIGHLANDS

South of the northern plains, the Santa Cruz district and the Chiquitos Highlands, differing from the adjacent forest in many ways, extend east to almost the eastern border of the country. The region includes the Santa Cruz plains and hills, the parallel *cuestas* and ridges separated by narrow lowland strips, that stretch south, east of the Yungas, to almost the Argentine frontier, and the so-called Chiquitos Highlands.

In contrast to the low plain of the north and the Chaco, the region rises throughout to more than 1,000 feet above sea level. Level to rolling, its surface lacks the vast areas of flooded lands and swampy areas of adjacent regions, though here and there local swampy tracts, in sand hill districts or where Andean streams enter undrained depressions, may be encountered, especially along the eastern margin of the foothill country. Southward from Santa Cruz, amid cane fields and green pastures, level lands stretch for long distances, the surface being broken frequently by dry arroyos from the west. While many small streams cross the foothills giving a broken country, only three large rivers continue: the Grande joining the Amazon system, the Pilcomayo the Paraguay, and the Parapiti disappearing in Chaco swamps southeast of Santa Cruz. A rough tableland dominantly of gneiss and sandstone with here and there prominent ridges, the Chiquitos Highlands divide the drainage of the Amazon and of the Paraguay systems. Ridges of gneiss in Sierra San Lorenzo and Mercedes rise to 1,800 feet; those of sandstone in the north of Sierra Ricardo and in the south San José and Sunsas rise to nearly 2,000 feet.

Climatically the region represents a transition between the hot

humid plains of the north and the more dry and sub-tropical districts to the south. Though well within the tropics, temperatures are not especially enervating except during the rainy season; even then rather constant breezes alleviate the oppressive heat. At that season, uniformly high, they stimulate vegetal growth. During the dry season the weather may be uncomfortably cool when temperatures at night may drop almost to freezing and when all who can seek the cover of a blanket or two at night. The annual rainfall aggregates 25 inches in the southwest and 40 inches in the Chiquitos Highlands. Rainfall régime marks two well-defined seasons: (1) a rainy one from October to May when most of the precipitation falls, bringing with it the scourge of flies and mosquitoes, but carrying away accumulated filth. (2) A dry season from May through September when most of the streams become mere ribbons or dry up, water holes become saline, cattle thirst for water and vegetation takes a xerophytic character.

The central portion of the Eastern Lowlands of Bolivia possesses varied vegetation, ribbons of tropical forest and strips of chaco types. On the drier sandy ridges low, scrubby, thorn-bush types prevail. On the broad plateaus or dry plains are savannas, well adapted for grazing. In more moist areas along streams or around water holes, where the land is always marshy, grow the palm forests and on slightly drier ground thrive the true tropical forest strips rich in species and difficult to traverse. Figs, oranges, limes, and bananas grow wild in much of the area. Corn, rice, cassava, cotton, wheat and vegetables are cultivated in the lowlands.

Though no modern highways exist, in contrast to the northern plains, overland travel, the only means of communication, is comparatively easy. Cattle paths and trails connect towns, *estancias*, and missions. Trails wind anywhere through open country. Near the towns oxcarts follow the broader trails, yet they seldom move far from where they were fabricated owing to numerous unbridged streams or arroyos. These huge carts hewn from native cedar and mahogany, heavily laden, mounted on two massive wheels, 5 to 7 feet in diameter, on wooden axles never greased, emit a constant chorus of piercing squeaks and groans as they roll along behind 1 to 5 yoke of sturdy oxen.

Population and Development.—The chief groupings of population of all Eastern Bolivia are scattered on the plains and in the broad

valleys from Santa Cruz to the banks of the Pilcomayo. In contrast to the forest Indian and *seringueiro* of the northern plains, the population here consists of agricultural folk, herders attached to a vast cattle estate, or Indians within the fold of many great missions established during the eighteenth century.

Preëminently a cattle country as a result of rainfall régime and consequent savanna lands, numerous cattle ranches embrace vast areas, some 40 to 200 square miles in area; they are managed by *administradores*, who lack thrift or industry. The owners spend their money and live in Buenos Aires or Europe. Though herds are large, little use can be made of them, a few cattle move to the Yungas and some are driven south to Argentina, but they serve chiefly as draft animals and supply dried beef for local consumption and hides for export. The industry suffers under most of the handicaps as that of the northern plains. On all estates a considerable attached population produces a variety of crops. Each estate has its sugar mill and its alcohol establishment. No modern implements or methods of agriculture exist. Activities embrace subsistence occupations and little else.

The Franciscan missions dominate vast areas. Each mission surrounded by a considerable village of Indian folk, is autocratically controlled by the *padres*, who make occasional visits to adjacent communities to heal the sick, minister to the starved soul, and to collect tribute. The missions have their own farm and cattle lands where the Indians, in practical serfdom, produce the necessaries of life.

As in other parts of Eastern Bolivia, remoteness, isolation, and ignorance retard advance.

THE BOLIVIAN CHACO

In southeastern Bolivia, from the Andean foothills to the Paraguay, stretches for hundreds of miles the least known portion of the Gran Chaco. A flat plain devoid of major topographic breaks and only a few hundred feet above sea level exhibits a combination of conditions repellent to human habitations and development. In the west the many streams that succeed in crossing the ridges of the Andean foothills shortly lose their waters in the thirsty Chaco. From the banks of the Pilcomayo to the Paraguay in latitude 21° S., a distance of

some 400 miles, not one stream has carved a channel in the recent sediments of the plain dipping slightly to the southeast.

Subtropical in temperatures, the region receives a good allotment of annual rainfall—from 30 to 50 inches. From November to April inclusive heavy rains flood vast areas; much of the Chaco then becomes a lake-dotted land; low relief, impervious subsoils in places and few drainage channels preclude rapid run-off. Then cattle often have to swim to high hummocks of land to keep body and head out of water. Mosquitoes are thick; flies abundant; locusts breed by the millions. Then follows the desiccating season from May to October when little rain falls, water holes dry up or become saline and stock suffer from want of water or forage. Locusts swarm out to all surrounding regions devouring all succulent vegetation in their line of flight.

This portion of the Chaco offers four distinct types of vegetation which alternate with each other more or less regularly, depending upon edaphic relationships. Low flat lands, flooded or water-soaked for a considerable part of the year, support palm groves or groups of tropical hard woods. On slightly higher ground are quebracho stands, though the Bolivian Chaco lacks the wealth of quebracho of the Paraguayan and Argentine Chaco. On sandy stretches or arid portions are thorny shrubs, cacti and *algarroba*. But vast areas of the Chaco with heavy soils support tall grasses and isolated clumps or solitary palms.

The Bolivian Chaco has lent itself to little development. Only along the Pilcomayo and the upper Paraguay have cattle *estancias* broken the solitude of vast Chaco. But here the cattle industry exists only under notable handicaps, greater even than those in adjacent lands. Adventurous explorers bent on thrilling experiences or on gathering native animals or bird life avoid much of the Bolivian Chaco; they skirt its edges on the north or the west. Thus the heart of the vast plain remains the favorite haunt of the nomadic, troublesome Chaco Indian, who requires little sustenance and who desires most to be left alone.

THE LOWLANDS OF EASTERN BOLIVIA IN THE FUTURE

Though nature in the northern lowlands of Bolivia be prolific in its production of crops and natural vegetation, its agricultural re-

sources lie dormant and probably will continue so for untold ages. Remoteness, plagues of insects and diseases, and forest Indian, who refuses modern civilizing influences, all hinder attempts at developing the hot humid lowlands (Fig. 119). This region, in all probability, will long remain the great wilderness it is today, a wilderness broken

FIG. 119. ON THE OUTSKIRTS OF COBIJA, BOLIVIA

A typical means of transport in the lowland of eastern Bolivia; note the steep roof of the thatched huts to facilitate rapid run-off of heavy showers. (*Courtesy of C. F. Marbut.*)

only by separated river settlements and small, isolated, interior communities.

To the south the Santa Cruz plains and the Chiquitos Highlands lack some of the disadvantages of the northern plains; but remoteness and consequent high costs of transportation prohibit the production of commodities for foreign markets. They cannot bear the excessive cost of shipment and compete with produce from more favored lands.

On the other hand the development of oil fields in the eastern lowlands may revolutionize districts not only in this region but would

provide better transportation facilities, provide fuel for industrial purposes that should be far reaching in their influence on Bolivia as a whole, a fuel-starved land. Surface indications of oil and gas exist in the foothills of the Andean slopes and in the departments of Tarija, Chuquisaca, Santa Cruz, Cochabamba, and Beni. Oil structures have been reported; nearly twenty wells have been drilled; in some places oil in paying quantities has been tapped. More than 10,000,000 acres of land are held in concessions by different oil concerns. However, with great over-production of petroleum in the world it seems that these remote pools will add little in the near future to the supply of the world. Though initiating marked local advance along other lines, petroleum developments probably would not provide a permanent basis of expansion for the lowlands.

As for the Chaco, the northward advance of the frontier of civilization in the Argentine Chaco and the Andean foothills and the settlements along the Pilcomayo and the upper Paraguay may indicate the lines of promise for this region as well as the Santa Cruz plains. Nevertheless, plagues of insects, isolated settlements, the uncertainties of a water supply and the native population combine to make difficult, or even hazardous, the trade or the mere livelihood of communities on the fringe of the region. Though the Bolivian government has fostered many colonization projects in the Chaco and given large concessions of land to individuals and development companies, none has resulted in permanent settlement. Furthermore, the government has expressed a desire to postpone all attempts at colonization in the Chaco to some future era when present agricultural areas have reached maximum development and the increase of population requires new lands. On the other hand, Paraguay has dispatched troops into its portion of the Chaco to police the region and prepare the way for orderly and permanent settlement.

CHAPTER XX

PARAGUAY

A backward inland country, Paraguay embraces about 171,000 square miles of subtropical lands, an area equal to two and one-half times the size of Uruguay or nearly three times that of New England, and supports a bare million people. Paraguay, like Bolivia, has no land bordering the sea, but the position of the republic of the upper Paraná lowland is in many ways far better than that of its western neighbor. The Paraguayan Central Railway, which connects to the Argentine system by ferry at Villa Encarnación, constitutes the only important line in the country. With branch lines from quebracho stands or *estancias* to the Paraguay River and the Central Railway, the country has slightly more than 500 miles of railway. The lowland republic lies a considerable distance from the Atlantic; Asunción is 1,000 miles from Buenos Aires within the principal consuming center of South America. The Paraguay and Paraná Rivers, navigable for vessels with fifteen-foot draft, from Concepción, afford an outlet to the sea. Regular freight and passenger services are maintained. Transportation conditions within the republic are meagre. Poor roads prevail. Good highways passable for automobiles throughout the year aggregate less than a dozen miles. During the dry season one of the roads may be used by automobiles for 56 miles. Travel over other highways involves losing the route in seemingly bottomless swamps, pulling through deep sand, and fording unbridged rivers.

HISTORICAL SKETCH

A number of historical influences profoundly affect Paraguayan life. Between the Paraguay and Paraná Rivers in the early sixteenth century, the Spaniards found a number of Indian tribes, who, although greatly different in customs, possessed a common speech, or *lingua franca*, the *Guarani*, which became the chief tongue of Paraguay. The first settlement in the province of Paraguay dates from 1536, when remnants of a party abandoned Buenos Aires, proceeded

up the river, and laid the foundations of Asunción, for the purpose of obtaining agricultural products from the Indians and forming a way-station to Peru. Connections with Peru, over difficult routes, soon broke down, forcing the isolated colony to depend on its own resources. The Indians, after a period of wars, succumbed to the Spaniards; miscegenation began on a large scale, resulting ultimately in the modern Paraguayan race. The Jesuit organizations, a powerful religious order, began operations in 1609; it gathered within its mission establishments thousands of natives who, being subjected to the strict measures of the order, gradually lost whatever individual initiative they may have possessed. In 1767, by Royal decree, the missions were broken up and the Indians helplessly left on their own resources.

In 1811, by bloodless revolution, the colony separated from Spain, establishing the republic of Paraguay. Between 1816 and 1840 the country, under the control of an absolute dictator, whose policy hindered all lines of progress, developed little. From 1844 to 1865 the infant republic, under the dictatorship of Carlos Antonio Lopez, took its first steps forward. Roads were laid out, and Paraguay was opened to the outside world, the first trading vessel reaching Asunción in 1852. Then followed, from 1865 to 1870, the great catastrophe in Paraguayan history: Francisco Solano Lopez, who desired to create an empire in the heart of South America with Paraguay as a nucleus, provoked Brazil into war, and invaded the province of Corrientes, Argentina. Uruguay joined Brazil and Argentina. This triple alliance practically crushed Paraguay. Territorial concessions, covering 56,000 square miles, were made on all sides. On the north, the land between the Apa and the Branco, including valuable *yerba maté* districts, was relinquished to Brazil; Misiones, on the left bank of the upper Paraná, and the land between the Bermejo and the Pilcomayo Rivers went to Argentina.

More serious than the territorial concessions, however, was the great destruction of life and property. Almost the entire male population over fifteen years of age had been annihilated. The noncombatant population was decimated by many hardships. Most of the cattle had been killed, depriving the country of the very basis of its subsistence. What there is in Paraguay today dates from the end of the great war, built up from the wreckage of a nation that was all

but destroyed. Since 1870 Paraguay has suffered severely from the vicissitude of internal political life; the last revolution terminated in 1923, leaving the country to enjoy the period of greatest prosperity in its history. Thus, the peculiar historical influences, which permeate all phases of Paraguayan life, include the Guarani-Spanish racial heritage, the long isolation of the country, the long subjection of the people to personal rule of Jesuit priests and dictator presidents, and the War of Lopez and subsequent revolutions.

POPULATION

With a population of only about 1,000,000, Paraguay has the fewest inhabitants of any South American republic. Most of the people consist of mestizos—descendants of the mixture of Guarani and early Spaniard. Approximately 92 per cent of the total population consists of mestizo and Indian. In portions of the forests of the Alto Paraná country and in large parts of the Chaco, the Indian population, chiefly semi-nomadic, is of a low order of civilization. At the head of the social system are descendants of the old colonial Spanish families. Decimated by the War of Lopez, these families, of relatively small importance, are engaged in law, politics, and to some extent in a quiet life on large *estancias*. Already a significant phase in the local social and political life, the most important element in Paraguay consists of Europeans—Italian, French, Spanish, English, and German. This class deserves most of the credit for the rise of Paraguay since the disastrous War of Lopez.[1]

From the forested lands of the east to the western extremity of its Chaco territory Paraguay's surface is only slightly utilized by man. While vast plains, covered with nutritious grasses and occasional stands of quebracho, extend for thousands of square miles in the Chaco, and great forests occupy 80 per cent of the rolling surface in the region of the Paraná basin, all but one per cent of the population lives in a low-lying, often poorly drained strip, chiefly to the east of

[1] In recent years a stream of sturdy Mennonite immigrants, three thousand strong, has moved into the northern Chaco of Paraguay, near Puerto Casado. They have broken the soil, reaped good harvests of a variety of tropical products, and have laid the foundations of a great agricultural colony in this sparsely populated area. On the vast areas included in the concession from the Paraguayan government, the Mennonite organization plans to establish shortly approximately 100,000 Mennonites. While this organization will develop a community within itself, such population increments mean much to the economic future of Paraguay.

the Paraguay River. This area is narrow in the north but widens somewhat in the south, so that at the southern boundary of the country the fairly well-inhabited region extends from the Paraguay River to Encarnación, the center of a rich district. Throughout this agricultural strip are many cattle, in the forests one finds *yerba maté* and many kinds of timber, while in the Chaco region are cattle and quebracho; furthermore, in this strip of cultivated land, most highly utilized in the vicinity of Asunción, grow cotton, tobacco, oranges, and several other crops used almost entirely for local consumption.

THE PARAGUAYAN ENVIRONMENT

Devoid of bold topographical features like most South American republics, and lacking the uniformity of conditions characteristic of Uruguay, this interior republic consists of either rolling lands or flat plains, much of which are poorly drained; it is essentially subtropical; hot and rainy in the main, it supports savannas in the Chaco and forests on the mountains and in the lowlands of the east (Fig. 120).

Relief and Drainage.—The Gran Chaco, the great triangular area between the Paraná and Pilcomayo Rivers, consists of a low-lying country of little elevation and less relief. With slight elevation above the sea and scant slope from the northwest, the Chaco is subject to rather extensive inundation. The saturated soil does not absorb the surface water; sluggish meandering and ill-defined streams drain the water off slowly; much remains after rains until it escapes by evaporation. Serious floods occur by the rising of the Paraguay, which backs the water into the Chaco several miles from the main stream. Here and there slight elevations provide safe havens for stock at times of heavy inundation. The soils of the Chaco vary from fine sands to heavy clays. The impregnation of salt during the long period of drought, an excess of water following the rains, and the presence over large areas of a heavy, hard, clay substratum restricts their productivity.

Adjacent to the Paraguay and Paraná Rivers stretch considerable areas of low-lying, river-bottom lands subject to frequent floods in the rainy season. Within, slight rises of fertile clay and sandy soils provide the chief crop and some important pasture lands of the country.

Stretching from the flooded lands of the Uruguay on the south to the Amambay mountains in the north, lie the hilly lands of eastern

Paraguay. These low mountain ranges, geological outliers of the old Brazilian highland, and the intervening valleys support a heavy forest growth. Broken series of hills, rising in places to slightly more

FIG. 120

The low flat plains of the Paraguay-Paraná Basin occupy a broad area between the outliers of the Brazilian highland in eastern Paraguay and Uruguay and the Pre-Cordilleras in western Argentina. Large areas consist of low swampy lands; (1) highland areas, (2) swampy lands, (3) railways, and (4) the northern limit of the Pampa.

than 2,000 feet above the sea, with many ridges and ramifications, the Paraguayan ranges constitute no serious barrier to movement within the region. Highly isolated, this area owes its lack of contacts chiefly to the forests which cover the mountains from the banks of the

lowest streams to the summits of the ranges. Soil materials of the great forest consisting of medium to heavy, reddish brown clays, and containing considerable iron and humus, produce abundantly when cleared.

Climate.—Lying between 22° and 28° S. latitude, Paraguay is essentially subtropical. The country has a considerable range of temperature; during the summer months the temperature may rise to 108° F and in the winter, in districts back from the rivers, it may

FIG. 121. CHACO PALM GROVES

Vegetation of the Chaco southwest of Asunción; closely grazed grasses, palm groves and grass alternate.

drop to 33° F. In general, three months—December, January, and February—are uncomfortably hot, one and one-half months disagreeably cool, and the remainder pleasant. Sudden changes of temperature, which are quite common, result from the rapid and rather frequent changes in winds, from the enervating hot north to the chilling south wind.

The annual precipitation increases from about 30 inches in the west to 60 inches or more in the hilly portions of the eastern part of the country. The rolling lands of the east have fairly even distribution of rain throughout the year; no quarter receives less than 8 inches. In contrast to that, the lands to the west have a long rainy

season extending from September to April, and a marked dry period in June, July and August, when much of the area receives 8 inches or less for the quarter. In these months streams become mere ribbons, waterholes dry up or become saline, and grasses wither.

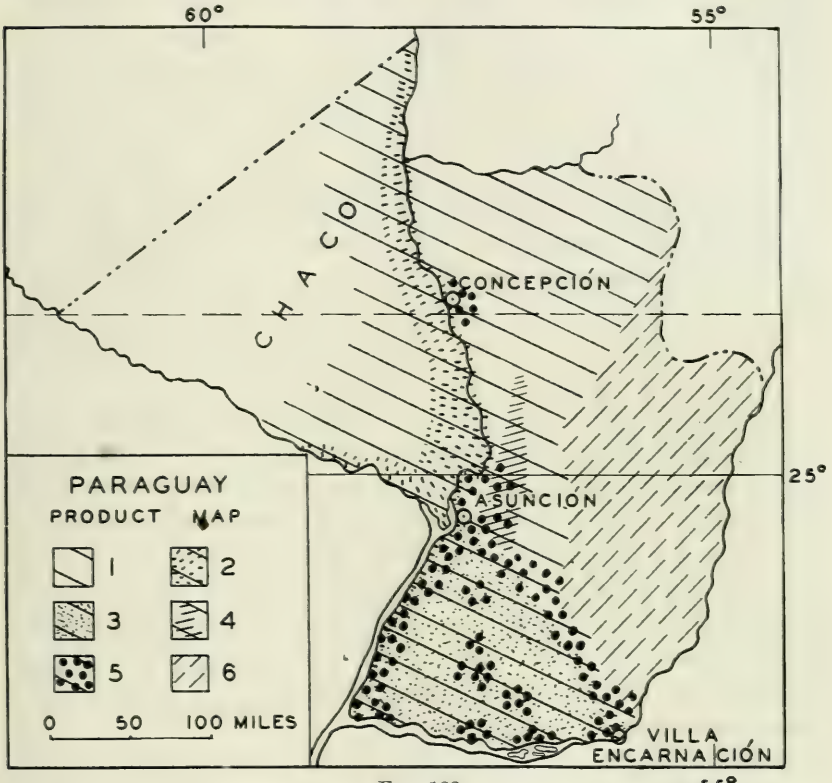

FIG. 122

Throughout central Paraguay the grazing of cattle is one of the principal industries. Most of the agriculture is carried on in the triangular area between the Paraguay and the Paraná Rivers, southwest of the railway line from Villa Encarnación to Asunción. The eastern portion still remains forested; here, the gathering of *yerba maté* claims the attention of a sparse population; (1) cattle areas, (2) the quebracho district, (3) corn—sugar—cotton—rice areas, (4) tobacco, (5) oranges, and (6) the eastern forests and *yerba maté* region.

Natural Vegetation.—The natural vegetation of Paraguay ranges from the essentially subtropical savanna lands of the Chaco to the forest areas in the hilly lands of the east and along the lowlands of the Uruguay. In the Chaco true forest belts, palm groves, patches and strips of tall grasses, swampy tracts, and true open grasslands suc-

ceed one another at varying intervals (Fig. 121). Towards the western margin the *algarroba* (*Prosopis sp.*) yields shelled fruit, used for making flour or a beverage, and supplies building material. The chief stands of quebracho extend in a narrow belt adjacent to the west bank of the Paraguay.

In the eastern part of the country are the tropical hardwood forests, supporting a wealth of species of valuable woods—*curupay, guayacán, incienso, lapacho, palo-santo* (lignum-vitae), and *ybirá-ro*. This indicates great prosperity for the forest regions with improved transportation. Many varieties of hard woods, of which *cedro*, or Spanish cedar, is the most important, meet the heavy demand in Buenos Aires. In addition to these timbers, the forest region supplies two products of special value, *yerba maté*, and oil of *petit-grain*, the latter distilled by the natives from the leaves of the bitter orange tree.

OCCUPATIONS

Lacking mineral resources of any kind and little water power, the country depends upon two major types of industries for subsistence and its commercial products. Though a major portion of the population tills the soil and tends the herds, large numbers are engaged in the production of forest products (Fig. 122).

The Forest Industry.—Of Paraguay's total area of 171,000 square miles, 60 per cent is forested. The chief forest areas include quebracho lands adjacent to the western side of the Paraguay, the lowland forests of the Paraguay and Paraná Rivers, and the tropical hardwood forest in the highlands.

Quebracho.—Although not engaging the attention of the major part of the population, the quebracho industry, from a commercial point of view, leads all other activities. In extract and logs it supplies nearly one-fourth of the total exports of the republic.[2] The exploita-

[2] The leading exports of Paraguay in 1928:

I.	Animal products	$5,926,500
	Cattle hides	1,757,600
	Meat extract	1,623,300
	Preserved meat	1,564,500
	Tallow	664,400
	Beef	244,500
II.	Forest products	5,280,000
	Quebracho extract	3,703,600
	Lumber and Posts	1,340,000
	Oil of *petit-grain*	230,000

tion of quebracho is confined to a narrow belt along the west side of the Paraguay, sections not far from cheap water transportation. Away from the river the number, size, and value of trees decrease as do also the number of forest belts.

There are three branches of the quebracho business: the exportation of logs for the manufacture of extract abroad, the original phase of the industry; the manufacture of extract in the quebracho region, and the exportation of the finished product; and the production of structural timbers, as a whole, a minor part.

The quebracho forests, now the most important source of tannin extract in the world, contain a variety of trees, but the quebracho colorado (*Schinopsis lorentzii*) yields most of the tannin extract, and the quebracho blanco (*Aspidosperma quebracho blanco*) supplies most of the lumber, though the quebracho colorado may be used for construction, posts, and ties. The former possesses a far higher tannin content than most woods of the northern hemisphere (twice as much as hemlock).

Natural conditions restrict the areal distributions of the trees. The best stands of timber grow where temperatures rarely exceed 105° F and seldom drop below 32° F. Vast stretches of level lands, which drain with sufficient rapidity to do away with long inundation and slowly enough to furnish sufficient moisture for the tree, support excellent stands; while these areas are flooded at times, the water does not become stagnant pools as it does away from the major drainage channels. The tree, whose moisture requirements are exacting, is rarely found on elevations 50 feet above the surrounding lowlands; it avoids both the slightly elevated tracts, which get very dry during the winter, and the depressions occupied by permanent swamps.

The quebracho industry is carried on for the most part by corporations. Extract companies depend upon their own vast timber holdings for a large proportion of the raw material, but they may purchase logs in the open market from small private organizations at times when they find it difficult to supply the factories from their own hold-

III.	*Yerba maté*	$1,664,000
IV.	Tobacco	799,500
V.	Cotton	625,000
VI.	Oranges (1926)	486,000
	Total Exports	$15,409,600

ings. Operations consist of two phases: cutting timber and transporting the logs, and the manufacture and export of extract. The former is almost entirely in the hands of contractors, who work on a tonnage basis, and who supply all equipment (Fig. 123).

Although the distribution of the trees within a short distance of rivers and the location of the plants on river banks favor the industry, it labors under several handicaps: (1) poor land transportation; in wet weather the roads become almost bottomless channels of mud in a short time; (2) extremes of wet or dry weather which put a stop to all field operations; the former floods the lands, the latter causes a scarcity of water and pasture for the stock; (3) inefficient labor; though plentiful the laborers are irresponsible and must be supervised constantly; (4) insects, especially mosquitoes and sand fleas; (5) malaria, and (6) forest fires.

Slightly more than a quarter of a century old, the industry has developed at a rapid rate.[3] At present the annual rate of exploitation

[3] EXPORTS OF QUEBRACHO FROM ARGENTINA AND PARAGUAY

(In Metric Tons)

	ARGENTINA		PARAGUAY	
	Quebracho Extract	*Quebracho Logs*	*Quebracho Extract*	*Quebracho Logs*
1893	a	63,297		
1894	a	74,358		
1895	402	172,949		
1896	684	83,266		
1897	1,205	135,675	(For the years 1893–1906 inclusive no records are available so far as the author has been able to determine.)	
1898	1,192	188,260		
1899	3,172	159,376		
1900	5,957	239,836		
1901	4,310	198,919		
1902	9,099	245,723		
1903	12,040	200,201		
1904	20,111	252,723		
1905	29,408	285,879		
1906	30,839	230,100		
1907	28,195	246,514	9,209	9,000
1908	48,162	254,571	13,136	18,106
1909	55,493	294,722	10,680	a
1910	53,231	341,969	11,538	14,888
1911	68,431	438,216	8,121	17,185
1912	74,910	279,342	7,298	3,689
1913	79,684	383,964	11,721	13,067
1914	80,153	291,942	12,710	8,417
1915	100,213	209,679	18,307	2,322
1916	97,574	161,734	21,136	1,006
1917	90,777	133,170	29,899	1,645

is somewhat more than 1,000,000 tons of quebracho logs, cut from about 500,000 acres. Recent estimates place the life of the industry at about 40 years at the present rate of cutting. However, these do not take into account the working of lower and lower-grade materials as tannin extract becomes more expensive. At present, only the

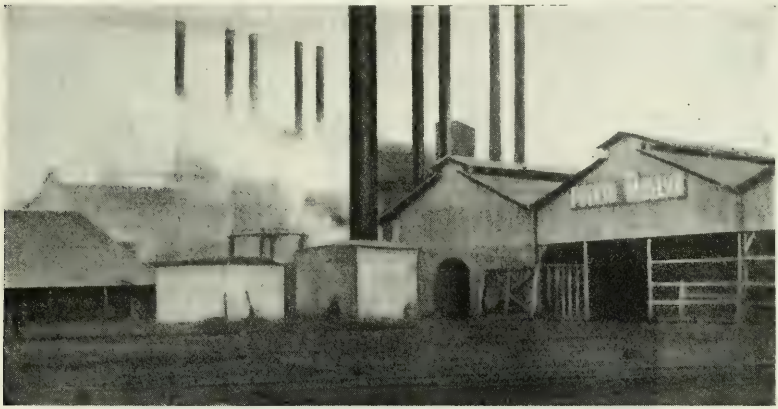

FIG. 123. AN EXTRACT FACTORY, PUERTO PINASCO, PARAGUAY

The quebracho logs go into the chippers and come out later as tannin. The location of the forests near the streams and the mills on the rivers afford cheap transportation for logs or extract to the ocean ports. (*From "Commerce of South America," C. F. Jones, courtesy of Ginn & Company.*)

heartwood, which yields from 25 to 30 per cent tannin, is used; the sapwood (outer section), which would give 3 to 4 per cent of tannin, and the bark, which would give 6 to 8 per cent, are discarded. Obviously as the timber is exhausted, these will provide tannin.

	ARGENTINA		PARAGUAY	
	Quebracho Extract	*Quebracho Logs*	*Quebracho Extract*	*Quebracho Logs*
1918	124,710	a	19,096	523
1919	139,700	54,600	32,976	1,668
1920	122,800	56,600	24,331	269
1921	94,300	40,000	29,356	a
1922	167,800	124,800	37,800	1,614
1923	204,000	123,800	35,139	5,271
1924	180,912	94,037	31,685	2,602
1925	214,183	131,520	64,662	2,374
1926	202,608	81,194	57,550	3,749
1927	198,807	129,104	46,975	6,594
1928	202,630	164,730	57,835	5,803

a. No record.

Furthermore, since the quebracho grows rapidly, new stands of timber, under a forest policy, may lengthen materially the life of the industry.

Timber and Minor Forest Products.—Paraguay, with its tremendous timber resources, holds an especially attractive position with reference to trade with Argentina, a country deficient in easily available resources of various types of lumber. While the combination of high temperatures, heavy rainfall, and rich soil results in a most luxuriant growth of vegetation, the forest industry labors under great handicaps. Not only do trees grow in small, segregated groups or singly, but the tangled mass of undergrowth affords an almost impenetrable

Fig. 124. On Margin of Eastern Forest Region

Bringing logs and wood to the railway for shipment to the treeless Pampa to the south.

wall, which roads must pierce. The heavy timbers reach river or rail slung between two high wheels and drawn by teams of oxen. A third source of considerable wealth in the forests, especially in demand now, consists of *petit-grain*, a base for perfumes and flavoring extracts, distilled by natives from the leaves of the wild bitter-orange tree. The chief requirements of the industry, as carried on at present, include a stream of clear water, a primitive palm-thatched shelter for a simple furnace fed by wood from the vicinity, and a large vat from which leads a pipe coiled in a cooling chamber where the condensed vapor gathers. On the whole, however, poor methods of production and restricted demands limit its importance (Fig. 124).

The Yerba Maté Industry.—Though classed by many among the agricultural products of the country, *yerba maté* engages the attention of some 50,000 people in the forest zone. In addition to a large native

consumption this product amounts to about 10 per cent of the total value of the exports of the republic.

Yerba maté (*Ilex paraguayensis*, or South American Holly), the basis of an extensive industry, grows throughout eastern Paraguay, except the low, swampy lands bordering the streams. It is an evergreen, attaining a height of 12 to 25 feet in the natural state in the forest. Bushy in habit, it resembles somewhat an orange tree. Its chief product, the leaf, is deep green in color, and glossy.

The plant, for the growth of a large quantity of small tender leaves, finds here favorable conditions. They include a heavy precipitation, fairly well distributed throughout the year, high temperatures, excellent drainage, fertile red soils, and a forest cover which protects the young plants from intense sunlight.

Yerba maté formerly was gathered principally from trees growing in the wild state, by bands of Indians, who entered the forest in considerable numbers at the beginning of each cutting season. Under the destructive methods employed, the number of trees decreased rapidly. These methods, an increased demand, and high prices led to extensive systematic cultivation of the plant. In a true sense the production of *yerba maté* has become an agricultural activity. However, after seedlings are transplanted from the nursery to the plantation, and after trees attain three years of age, the plantation receives little attention, except that brush and trees may be chopped out, and the trees pruned at intervals.

The harvest season lasts, in general, about six months; at that time the pruners enter the plantations and the forest, cut the branches bearing the tender green leaves, roast and dry the leaves over fires or on some of the large plantations in special pans set in a brick furnace, and pack them for shipment. Since most of the *yerbales* are located on well-drained uplands away from the streams, the prepared *yerba maté* moves over muddy trails or roads on the backs of human porters, on mules, or on oxcarts to the rivers or the railways, the chief outlets.

While *yerba maté* is consumed in large quantities in Paraguay, northern Argentina, southern Brazil, and Uruguay, several conditions, chiefly economic, retard its more extensive cultivation. They include a small supply of inefficient labor; poor methods of cutting, drying, roasting, and packing; inadequate transportation facilities;

and the lack of equipment and organization to insure for the consumer a uniform high-quality product.

Production of Crops.—While much of the territory of Paraguay is fertile and tillable, as yet the hoe and the plow have brought under cultivation only a small portion of the country. In a recent year (1926) only 200,000 acres were cultivated. Corn and oranges cover the greater part of this area, while cotton, tobacco, potatoes, beans, sugar, rice, and *yerba maté* make up the remainder.

The chief farming districts of Paraguay lie in the triangular area bordered by the Paraguay and Paraná Rivers and a line drawn from just north of Villa Encarnación to north of Asunción, a short distance east of the Paraguay River.

Paraguay is neither a land of small independent proprietors nor of extensive or large-scale farming. The average farm consists of a small rented tract of a few acres, on which the *campesino* raises enough for the needs of his family and some surplus for exchange for produce in the nearest town. He rents of the landlord on shares, paying from 15 to 30 per cent of the crop. He provides his own house, which consists of a thatched adobe hut of one or two rooms. His implements are few and the methods employed are crude.

The farm products of Paraguay, for convenience of discussion, may be grouped in two classes: those which, in addition to supplying a considerable local demand, contribute substantially to an export movement, and those produced entirely for local consumption. Tobacco, cotton, and oranges constitute the chief commercial products.

Cotton.—Known since colonial days but of scarcely any importance as late as 1916, when the crop occupied 120 acres, cotton now constitutes a significant export commodity of Paraguay. Cotton grows chiefly to the east of Asunción and along the railway line from that city to Villa Encarnación. In general this area offers conditions of climate and soil favorable for the growth of cotton. Frosts seldom occur, the yearly average being only four; sufficient precipitation, well distributed, and a large percentage of sunshine especially during harvest season are especially auspicious. The red, deep, calcareous loam soils, with varying sand content, known as "tierra colonada," give good results; forest soils, in general, are more productive than unforested soils. But labor, although cheap, is scanty; lack of transportation facilities and distance from exporting centers cause high freight

rates; and lack of uniformity in variety and length of staple tends to retard the industry, though the fiber is of good quality. In the decade 1916–1925 the cotton acreage increased almost three hundredfold, the principal impetus coming in 1923, when acreage jumped from 10,000 to 42,000.

Under the direction of the *Banco Agrícola* the cultivation of cotton has caused a progressive modernization of agricultural methods. Many cotton growers, working on the family-farm basis, have discarded the old crude implements, the primitive plow, harrow, and hoe; cotton is produced entirely on small holdings; fields consist chiefly of mere patches. Moreover, methods of ginning and baling improve. Sold at planting time by the grower, cotton is ginned and baled by exporters. The cotton grown consists primarily of two native varieties: "algodón paraguayo" and "algodón colorado"; types are badly mixed and length of staple varies greatly; grading at present considers only maturity, color, and freedom from trash and discoloration. In cotton, Paraguayan producers have found an excellent source of income; whether the industry can hope to grow in importance depends primarily upon four factors: competition with essentially basic crops of long standing, such as tobacco, corn, and sugar cane; solution of the labor problem; improvement of transportation facilities; better methods of picking, grading, and baling; and establishment and retention of markets in view of the increasing production in adjacent countries.

Tobacco.—Tobacco, long holding first place in the agriculture of Paraguay, still increases in acreage. Grown principally in an especially favorable region of red sandy soils and excellent climate, known as the Cordillera, situated north and east of Asunción, tobacco comprises an unusually distinctive part of Paraguayan life, as essentially so as *yerba maté.* Everyone, from the mere tot to the most venerable ancient, smokes; the distracted mother, more often than not, places her cigar in the fretful infant's mouth to quiet it. Daily consumption of the ubiquitous cigar averages seven per person. Furthermore, exports reach large figures. Little wonder that fluctuations in the tobacco crop affect the agricultural classes more directly than do those in any other article of native produce. Ranking next to corn in acreage, the plant occupies more land than the combined total for all other crops, exclusive of cotton.

The methods of production continue to be primitive, but a fairly good quality leaf for export undergoes careful inspection by representatives of *Banco Agrícola.* Much tobacco, in competition with the Brazilian product, moves into Argentina. Practically all exports pass through the Oficina Revisadora de Tabacos y Mercado de Frutas, which, under the direction of the *Banco Agrícola,* maintains in a modern steel and concrete building a storage capacity for more than 40,000 bales, each weighing 22 pounds. The careful methods of grading—seven classes are exported—have been effective in maintaining the prestige of Paraguayan tobacco in foreign markets.

Oranges.—As typically Paraguayan as tobacco and *yerba maté,* oranges, while yet a minor export item, will contribute an increasing income. Cultivated and wild trees occur in great numbers in a region tributary to the main rivers and the Central Railway. In addition to natural propagation of the indigenous variety, seeds of Andalusian and Valencian varieties, introduced by the Jesuits, have been scattered far and wide by man and bird, with the result that orange trees abound in many districts. Paraguayans bestow little care upon the tree; even within the zones of greatest production orchards receive little attention. Nevertheless the fruit is large, of excellent flavor, and juicy.

So poor are facilities of handling and transportation that millions of oranges go to waste every year; a basket holding two or three dozen may be purchased for a few cents. Generally small growers bring the fruit to the railroad or river in jolting oxcarts and roughly unload the crop (Fig. 125). Then laborers, usually women, load them on the conveyance in heaps so large that by the time the ship or train reaches market the lower layers are so bruised as to be unsalable. Sacking and box material involve too great an expense; consequently the arrival of fruit in good condition is confined almost entirely to chance. In addition, Paraguayan oranges must meet severe competition by Brazilian and Argentine oranges in Buenos Aires, their principal export market.

At present, however, the industry prospers. The *Banco Agrícola* now directs the selection, grading, and crating of the crop grown by 80 per cent of the owners, and has caused marked improvement. Prices have more than doubled; the demand increases. With large orders and the campaign for improvement well under way, its

oranges assure Paraguay of a very substantial increase in at least one class of exports in the near future.

Subsistence Crops.—Corn, cassava, and oranges occupy the greater portion of the cultivated land. Corn and cassava, staple articles of diet among all classes, are produced wherever people dwell. With little care or cultivation, yields are low and the product of poor quality, but they suffice to meet the needs of the backward population. In addition, several other crops favored by the fertile lowland

FIG. 125. ORANGES AT YUTI, PARAGUAY

Transferring oranges in bulk from oxcarts to railway for shipment to the cities of the Pampa; cattle are fond of oranges. (*Courtesy of Ernest G. Holt.*)

soils, high temperatures, and much precipitation augment the food supply of the native; rice, planted chiefly in the flooded lands along the Paraguay, in the swamps to the southeast of Asunción and on the flood plains of the Uruguay; sugar, beans, peanuts, some potatoes and fruits, grown with little attention, emphasize the prolific subtropical climate of this lowland country and the low cost of living which reduces the incentive for work.

Possessing fertile soils, subtropical temperatures, and abundant precipitation in two-thirds of its area, Paraguay has less than one-fifth of one per cent of the land under cultivation; but it probably possesses a total of 50,000,000 acres fairly well adapted for crops and

livestock. Crop areas may be increased many fold with increased population, better transportation facilities, larger markets, seed selection, improved methods of culture and active measures to combat insect pests and diseases. The crops of the future will be those thriving in Paraguayan soil today.

The Animal Industry.—Paraguay, in many ways especially suited for crop raising, devotes 34 per cent of the entire area of the country to the raising of cattle, horses, sheep, and hogs.

Cattle.—The cattle-raising industry in Paraguay, like that of Venezuela in many respects, has suffered greatly from wars. From an introduction of 8 head in 1546 there were 3,000,000 in 1800; the animals increased rapidly and comprised an important source of food. The war with the Triple Alliance, however, practically wiped out the industry, since the armies lived on the beef of the land. Only a few thousand half-wild, poor-grade cattle, remote from the scenes of hostilities, remained to repopulate the plains of Paraguay; in 1870 estimates placed the total at 15,000. But with importations from the neighboring cattle areas of Corrientes and southern Brazil the numbers increased rapidly to almost 3,000,000 in 1900. At present they total nearly 5,000,000, somewhat below the normal figure, as a result of wholesale slaughter during the World War.

Principal among the cattle regions are the southern lands known as the Misiones, bordering the Paraná and the Paraguay Rivers, the northern savannas, and the Chaco. The Misiones area, the oldest cattle region of Paraguay, offers luxuriant, luscious pasturage on its low, often inundated lands. Little affected by frost or drought, grazing may be carried on all the year. The northern savannas, tributary to the city of Concepción, produce a better grade of meat than does the south for the abundant pastures contain grasses of good quality which are harder than those in the south. The Chaco, newest among the regions, also possesses the most favorable future; while pasture is scarce in parts, a growth of high grasses covers most of the land; sparsely settled, little is known about this region as a whole. Although it offers extensive grazing areas, many conveniently saline water holes, and greater freedom from ticks than is found in the eastern lands, utilization of the Chaco for grazing also involves combating inundation over enormous areas at some seasons—a curiously hard substratum prevents the rapid drainage of water—and at

others, disastrous droughts. In carrying capacity all these ranges rank far below those of the Pampa and those of Uruguay. As is the case in all Paraguayan production, lack of transportation facilities severely handicaps the industry.

With the improvement of both transportation and the quality of the animals, cattle-raising can become the leading exporting industry of Paraguay (Fig. 126). Even at present with multitudinous shortcomings in the industry, animal products, principally cattle hides, contribute 18 per cent of the total export trade. Improvement of

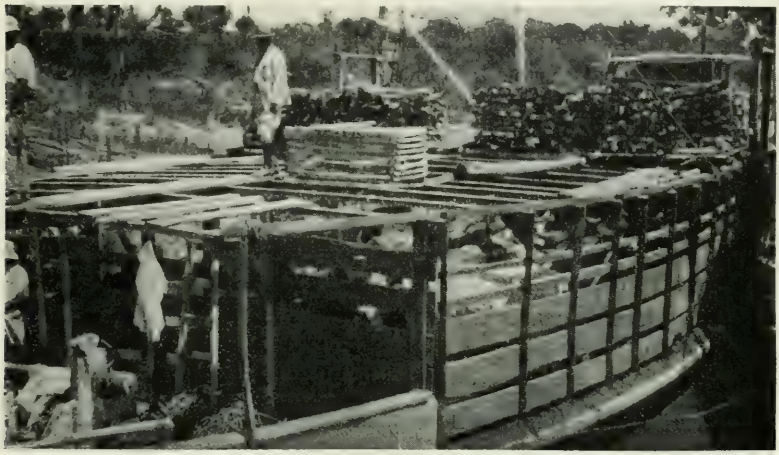

Fig. 126. Chaco Cattle on River Lighter

Lighters of cattle from the Chaco on the Paraguay being towed by wood-burning steamer to Asunción to be unloaded at the local market.

quality is probably as vital as transportation. All except 17 per cent of the cattle are of the creole type. Long-legged, wide of horn, large of frame, and seemingly without capacity to fatten well, they can attract little trade in competition with the stock of Argentina and Uruguay. As a result of an increasing demand for better meats during the war, efforts have again been initiated to improve the stock. In the northern areas zebu cattle, while lacking the bulk and beef qualities of European animals, have improved the herds somewhat. Imported from Brazil, to which they were brought originally by Portuguese from India, the zebu proves well adapted to the lands; nevertheless the mixed breed does not dress well; already attempts are being made to breed out the zebu blood. In the south, where the

introduction of stock has been possible, European breeds have had most influence, chiefly the Durham.

Prior to the establishment of three American meat-packing plants, exports of cattle products comprised a very minor item of trade. Domestic consumption took care of some 150,000 head, and the industry remained almost static. To meet demands for canned beef, thousands of Paraguayan cattle reached Argentine factories during the last years of the World War; as a result three American plants were established, only to close operations at the end of the war, two of them permanently. In addition to the plant reopened, a new one is in operation. With the opening of the second in 1925, exports of jerked beef shortly tripled. On the other hand, as a result of good domestic prices and an Argentine embargo, exports of cattle on the hoof have dwindled to negligibility. Tallow constitutes an additional item of animal products which has increased in importance.

While hopes for the exportation of frozen beef have been entertained, it will be long before the Paraguayan product can begin to compete with that of Argentina and Uruguay, which is not only better in quality but also nearer the world's markets. Cattle hides still lead in animal products exported, but meat extract, and preserved meats almost equal those of hides; beef and jerked beef also increase rapidly.

Other Animals.—Though horses, sheep, and swine have been members of the animal family of Paraguay since early colonial days, they play a minor rôle in the present livestock industry. Horses are used chiefly for riding purposes on the *estancias*. Sheep, consisting largely of creole stock unfit for packing purposes, produce a short, low-grade fiber; they fare poorly in this hot moist region on wet lands. Swine left to forage for themselves yield a local supply of poor quality meat and lard. No packing plants are equipped to handle them.

Manufacturing.—The older formations of eastern Paraguay may contain some of the basic minerals for manufacturing, such as iron and manganese and possibly copper near Villa Encarnación. But the country lacks coal and oil. Comparatively large water power resources lie untouched. Wood, the chief factory fuel, despite its abundance, is procured at considerable expense. Unskilled and shiftless labor hinders factory operations. Capital is not available in quantities for employment in industries suffering under these major handicaps.

The chief factory units of the country include quebracho plants, *frigoríficos*—meat-packing and extract establishments—sugar refineries, and brick kilns. Many small wares, made by hand in small shops, consist of furniture, leather goods, shoes, matches, cigars, alcohol, and soap. Thus restricted in resources, power, labor, and capital, manufacturing industries cannot loom large in the economy of Paraguay.

PROSPECTS

A country almost three times as large as New England, Paraguay's resources have been scarcely touched. Rich forests, extensive areas

FIG. 127. AT VILLA RICA, PARAGUAY

Tall, rough, bony cattle do not produce good meat even on excellent savanna grasses; primitive transport prevails over most of Paraguay. (*Courtesy of Ernest G. Holt.*)

of fertile agricultural land, and vast plains covered with nutritious grasses are the three keys to the future of Paraguay; their influence will be realized in full only upon the improvement of conditions which hinder the free development of the country.

Paraguay, of course, can never alter the fact that it is located far from the sea. Progress must always contend with this major handicap. Aided by water and rail, the old, almost complete isolation has been eliminated; Asunción enjoys regular water and rail services with Buenos Aires. While conditions of transportation between the country and the sea fall far short of approaching excellence, nevertheless

they have immeasurably facilitated the growth of the country. With the improvement of the great rivers and the important inter-republic rail links, Paraguay's primary connections with the world will assume an even greater degree of significance. In order to utilize its external communications fully, Paraguay must meet the problems of internal transportation, for poor roads have long been a major obstruction to the spread of economic progress (Fig. 127). To utilize better its resources of forest, farm, and savanna, Paraguay faces the problem of making marked improvements in highway and railroad systems.

Moreover, the introduction of modern and more efficient methods in agricultural and pastoral industries, the inculcation of knowledge of Spanish among the masses, concerted action to reduce the ravages of insect pests and diseases, the immigration of more progressive peoples like the sturdy and determined souls of the great Mennonite migration, and the eradication of a too docile native temperament comprise additional requisites for the utilization of 50,000,000 acres of its lands fairly well adapted to crops and animals now scarcely touched, and for the future prosperity of Paraguay. Already the freedom from bondage to tobacco has effected the inauguration of such developments. Cotton has given to Paraguayan producers the unfamiliar thrill of surplus funds. Paraguayan cotton has found acceptable markets and will continue to do so. It has brought the beginning of a notable modernization of agriculture; imports of implements have increased greatly. Plans for the provision of adequate means of water, rail, and highway transportation and communications, well under way, will break down the isolation of three centuries, lift struggling man and beast out of the muck and mire, and swing the republic into the march of progress characteristic of the present century.

CHAPTER XXI

ARGENTINA

Argentina, the second largest country in the continent with 1,153,000 square miles, occupies an area equal to one-third of that of Europe or to that of the United States east of the Mississippi River with Louisiana and Texas. In latitude it extends from the northern end of James Bay to Havana, Cuba, a distance of more than 2,300 miles. It is the leading republic of South America and the tenth commercial nation of the world. Yet, occupying the major portion of the temperate plain of the continent, it harbors only a little more than 10,000,000 people. Why should such a vast empire, in this age of advanced civilizations, have so few people? An answer to the question may be found in the indigenous folk and immigrant peoples, in the complex of geographical environment, and in the historical influences that have moulded the nation. One without the other does not give a complete picture of the real Argentine (Fig. 128).

HISTORICAL BACKGROUND

Unlike Chile, Argentina did not expand from a nucleus in the center of the country—the Central Valley. Contrasted portions of the land and different inhabitants initiated lines of development, even before Spaniards set foot on Argentine soil, that have been augmented and added to through nearly four centuries of slow evolution. In the arid mountains of the west and northwest sedentary groups of Indians had evolved irrigation agriculture. In the north Guarani and other Indians lived by hunting, gathering fruits from the forest, and raising a little corn. From the Pampa to Tierra del Fuego nomadic Indians lived by the chase on the guanaco and other native animals of that vast grazing land. The Argentine Republic grew out of the union of these different regions and the developments they fostered—primarily from two centers, the arid mountainous northwest—the Irrigated Oases—and the level humid east—the Pampa.

Long before the Spanish *Conquistador* began his exploits in South

America, exploits which led him to the lands of Argentina, Inca enterprise had developed an amazingly efficient agriculture in the oases regions of northwestern and western Argentina. Under the careful direction of Inca engineering skill, developed in a region engendered through understanding of possibilities for cultivating mountain

FIG. 128. THE HOME OF A WEALTHY CATTLEMAN

In a land which a century ago harbored fierce nomadic Indians and in which roamed wild cattle and horses, one finds today such luxurious homes and gardens with imported trees as shown in this picture of the *Quinta* at Plátanos; there are *peons* to care for it. (*Courtesy of the Buenos Aires Great Southern Railway.*)

slopes, both tributary and wholly dependent tribes had brought the irrigation and intensive cultivation of Peru to the eastern slopes of the southern Andes. From their experience gained in expanding their vast holdings of Andean regions, these early peoples had recognized the agricultural suitability of the piedmont slopes. Accustomed to the aridity and well versed in the meaning of snow-fields and glaciers, on the alluvial fans of western Argentina and in the intermountain valleys they constructed irrigation works from which the agriculture of modern Argentina derives immense benefit.

The Advent of Spaniards.—After the southern part of the broad Bolivian plateau submitted quietly to the Spaniards, a stream of *Conquistadores* moved onwards into the lands now belonging to Argentina. In the arid plains and valleys of the northwest they established themselves as feudal lords, took over the irrigated lands of the Indians, and kept the inhabitants as intact as proved feasible to provide agricultural labor. Soon the mineral developments of the Bolivian Plateau began to require provisions that could not be produced by the lands bordering the mines. Thus, cattle for beef and mules for transport moved in ever-increasing numbers from the flourishing communities established in all the important valleys of northwestern Argentina.[1] These settlements formed a part of Upper Peru; all relations, political and commercial, were with Potosí and Lima. For the produce supplied on foot to the mining regions, clothing, ammunition and other supplies came from Spain via Panama and Lima.

A short time after the Spaniards entered Tucumán from Potosí, adventurers came over the Andes from Chile into the Mendoza region. In pursuance of the orders of Hurtado de Mendoza in 1561, which sent an expedition from Santiago to climb the Andes and establish a city on the eastern slopes, a group of Spaniards descended the valleys leading to the Mendoza Oasis. In possession of the land they found warlike natives. Inca-governed peoples, the Hurapos, irrigated the farms of a large agricultural colony which they had developed to the north of the Rio Mendoza. Excellent agriculturists, they produced quantities of corn and potatoes, and according to early reports, wheat.[2] Dispossessing the tribe of the land, the Spaniards made no attempt to expel the natives. The Indians became the chief source of wealth to the conquerors in furnishing the only available labor for the irrigated farmlands. Together with San Juan, founded a year later, Mendoza became the leading center of the province of Cuyo, which remained Chilean for more than 200 years. The agriculture of the

[1] Though the mountains supplied little in the way of minerals, the chief interest of the Spaniards, northwestern Argentina did not lack important centers. By the end of the sixteenth century most of the leading centers of today had been established. Santiago del Estero was founded in 1553, long the capital of Tucumán; Córdoba in 1573, by a group from Santiago del Estero; Tucumán in 1565; Salta in 1582 as a result of the mule trade; Catamarca in 1685; La Rioja in 1591; and Jujuy in 1592.

[2] Vincenzo Vaciria: "La Provincea de Mendoza e gli italiani," Mendoza, 1911, pp. 29–30.

region flourished, but its early development attained no great importance because of the lack of markets beyond the settlement. To the east stretched the arid *monte* and the Indian-infested Pampa. To the north were similar oases and the Central Valley of Chile produced commodities like those of Cuyo.

Though the Atlantic side of Argentina was entered before the northwestern portion, Spanish settlement, among peoples who had not progressed beyond the wandering hunting stage in small tribal units, proceeded along entirely different lines. The year of 1516 brought the Rio de la Plata into the realm of geographical knowledge, yet the lands bordering the stream lay without successful settlement in Argentina for nearly two-thirds of a century. After two unsuccessful attempts at settlement, Buenos Aires came into being in 1580.[3] In that year on a slight rise near the Riachuelo Creek 200 Guarani Indian families and Creoles from Santa Fé settled Buenos Aires. They brought horses, cows, sheep, carts, seed and munitions; they were accompanied by a mounted convoy of Creoles born in Paraguay—the first *gauchos* of the Pampa (Fig. 129). Thus the first occupation of the Pampa proceeded by regular steps from Paraguay. The land around Buenos Aires was parcelled out in farms and ranches. The settlers found exceedingly war-like neighbors and discovered that the plains were thickly populated with horses and cattle, the descendants of the few left there forty-five years before by Mendoza's expedition.

The region of the Rio de la Plata, in contrast to those about Tucumán, Mendoza and Salta, after the settling of its principal town developed only slowly, in the face of auspicious natural conditions—the ocean highway, level fertile land, abundant forage, agreeable climate and a wealth of wild cattle and horses. Indian hostility was fierce; war-like, scattered tribes ambushed small parties and fled from

[3] Pedro de Mendoza, who came to the Rio de la Plata as governor of the territory south of the Portuguese possession, founded Buenos Aires in 1535 as a base for advance up the Paraná to discover and conquer another Peru for its wealth of gold and silver. Indians in scattered tribes gave the Spaniards no end of trouble; they would not and could not supply food. The settlement was abandoned within a year and fragments of the expedition proceeded up the river; in 1536 remnants of the party founded Asunción, the first Spanish settlement on the Atlantic slope of South America. The colony grew slowly but the natives fell into slavery by the thousands on the large plantations. An outlet to the sea became necessary, so in 1573 Creoles and Spaniards from Asunción founded Santa Fé. Thus began the reign of the Creole in the saddle, the *gaucho*, that was to mean so much to the Pampa and Argentina.

large ones. The region offered no wealth in gold and silver, still uppermost in the minds of most colonial Spaniards; the Indians could not easily be subjected and enforced to work on the land. The Creole *gaucho* from Asunción and Santa Fé had already tasted of the free open life in the saddle; he would not till the soil. And finally, in this settlement established without direct order from the crown and under the control of Paraguay, trade directly to Spain by sea was prohibited by the ban of 1599 under penalty of death and forfeiture of property. Only by one authorized route could the settlers communicate with

Fig. 129. Home of "Gaucho," Ceres Province of Santa Fé

A modern home of a *gaucho* on a large *estancia;* the *gaucho* lives a simple life in the saddle with few conveniences and no luxuries, compare Fig. 128; introduced *paraiso* trees.

Europe.[4] For example, imports from Spain went first to the Isthmus of Panama, there disembarked, then by mule back to the Pacific; along the Pacific coast, steamers took the products to Callao, then land carriage occurred again to the Bolivian plateaus by way of difficult passes, and finally the goods descended to the plains of Argentina and reached Buenos Aires. Mules, cattle and hides moved in the opposite direction.

Caravans of pack-animals transferred goods between Tucumán, Córdoba and the seaboard; too frequently thirst and Indians completely wiped out many expeditions. The amazing increase of animals on the Pampa, favored by nutritious grasses, moderate temperatures throughout the year, a rainfall of 30 to 40 inches, level plains, and the lack of shackles of domestication gave rise to the hunting of

[4] *Documents para la Historia Argentina,* Buenos Aires, 1915, Tomo V, "Comercio de Indias" (1713–1778), pp. 41–48.

horses and cattle for their hides by the Indians and Creoles. Nowhere in the world could hides be obtained so cheaply—a Creole with a fast pony, a rope and a knife possessed enormous wealth.

The region, practically strangled by the difficulties of trade with the west and the ban on trade through Buenos Aires, developed the most open-handed contraband trade of all times (Fig. 130). Open to the sea, it was easily reached from Europe; to prohibit this trade

Fig. 130. Grain Elevators, Buenos Aires

A center of great contraband trade during the colonial days, Buenos Aires today stands a great modern entrepôt for the Pampa and Argentina; having modern facilities in every way, the port ranks with the best of them. (*Courtesy of H. G. Olds.*)

Spain could not withdraw her fleets from the Caribbean, through which moved the wealth of minerals from the Andes. Consequently, the slaughtering of animals increased, smugglers prospered, and Buenos Aires developed into an entrepôt for the Pampa and the larger districts of the west—Tucumán and Cuyo.[5] In order to have a governor on duty at Buenos Aires all the time to stem this growing contraband trade, the Spanish government in 1617 created the province of Buenos Aires by taking all the territory southeast of Paraguay

[5] In 1608 the salting of beef for sale to Cuba and Brazil began; horse hair found a ready market in Europe; so important was it that attempts to monopolize it by the governors resulted in numerous outbreaks of Creoles. Clothing, wines, and other supplies moved to the west, while silver was smuggled in large quantities. The discovery of the Cape Horn route brought many contraband ships. In 1658 at one time 22 ships lay off Buenos Aires laden with hides, meats, hair and silver. In that year British ships smuggled 300,000 hides.

away from that province.[6] But no governor could stop or control the trade; it was beyond the power of any man or law to check this flow of commodities that had gathered so much momentum. Then followed a quick succession of governors; smuggling increased in spite of repeated efforts to stop it.[7] Development continued apace in the west and east along different lines in response to contrasted conditions. In Tucumán and Cuyo, with agriculture as the economic basis, Indians and Creoles largely had amalgamated, politically and socially; the Spaniards dwelt in the towns and supervised the Indians laboring in the irrigated valleys. In contrast, in the east, with hunting wild animals and contraband trade as the economic basis, the waving sea of Pampa grasses bred a new race of men—the *gauchos*, as independent as the original Indians—and an aristocratic and democratic society in Buenos Aires with weakening ties to the mother country. But even in the closing years of the colonial period this new development controlled completely a surprisingly small part of the Pampa, though animals had overrun much of it. Hostile Indians only a few miles west of the Paraná became an ever greater lurking menace with the same animals that formed the wealth of the region; and in Entre Rios they were dominant. The cultivation of crops had claimed but a patch of that vast domain.

Revolution and Independence.—This new land of Buenos Aires, totally different from other portions of the Spanish Domain, did not fit into the Spanish scheme of things. Here throughout the colonial period, in the numerous restrictions placed on the natural lines of devel-

[6] At that time four provinces included the lands east of the Andes. The provinces of Paraguay, Buenos Aires and Tucumán, administered separately, were directly dependent to the *Audencia* at Charcas and the Viceroy at Lima; Cuyo was subject to the Captaincy-General of Chile.

[7] By law from 1600 no ships, coastwise vessels or ocean carriers could enter and unload or receive cargo at Buenos Aires. But early in the eighteenth century the commercial policy of the Spanish government became more lax.

After the system of fleets under convoy in the Caribbean was abandoned, individual ships, equipped to escape capture, carried the cargoes. Many came to Buenos Aires. The decline of the mines in the highlands increased the importance of Buenos Aires. To bring this region more directly under Regal Authority the Viceroyalty of Buenos Aires was created in 1776. It included all lands southeast of Lake Titicaca; the province of Cuyo was detached from Chile and made a part of it. Thus for the first time, nearly two centuries after Buenos Aires was founded, political moves began to conform to natural laws. In 1790 Buenos Aires enjoyed for the first time free commerce with the mother country, but with no other. By the end of the century it easily led all other districts in population and in trade.

opment, the seeds of revolution and independence were being sown. Then in the early years of the nineteenth century, while the region was suffering from a lack of Spanish ships, because they were being swept from the sea by England and France, the English descended upon Buenos Aires and took the city (1806); but it was retaken at once by the Creoles, reinforced from Montevideo. The next year a much larger contingent of British soldiers attempted to recapture this promising region, but without success, though the force at Buenos Aires had no help from Spain. This success revealed the military power of the Argentine Creoles; the invasions tremendously revived commerce; English goods became available to *gauchos* as well as the wealthy; and Buenos Aires flourished on the trade with the interior provinces. In May 1810 word came from Europe that Spain was under the heel of Napoleon and no longer had power to help. Then on the 25th of May, 1810, the Argentine Creoles, in a great armed assembly, in Buenos Aires proclaimed the independence of the Creoles from Spanish authority. This spark of independence kindled into a flame that swept like wild fire across the Pampa to the boundaries of the Buenos Aires Viceroyalty in Bolivia, there to be temporarily checked, but fanned into a fire that ultimately swept the continent of Spanish control.

This move in Buenos Aires did not bring peace; the forces in power there assumed the sovereignty of the whole Viceroyalty, disregarding the interests of the western portions. Revolutions followed in quick succession; each province—Buenos Aires, Tucumán and Cuyo bred many factions, each trying to establish, by force of arms, control of the province and the nation. Decentralization became dominant.[8] The story of Argentina from 1812 to 1868 is one of civil strife, disturbances and armed revolutions.[9]

[8] Many of the factions broke away from the central authority of Buenos Aires and the provincial authority and formed new provinces. The cities of Santa Fé, Córdoba, Paraná and Corrientes, each with adjacent territory, aspired to the status of independent provinces. Cuyo separated into Mendoza, San Luiz, and San Juan. The province of Tucumán became Santiago del Estero, Tucumán, Catamarca and Salta.

[9] The first general congress assembled in Buenos Aires in 1825; the next year the first president, Rividavia, took his chair; the following record of presidential succession strikingly characterizes conditions in the country.

Rividavia	1826–1827, forced to resign by opponents;
Dorrego	1827–1827, driven out, captured and killed without a trial;
Lavalle	1828–1829, defeated and driven out of the country;
Rosas	1829–1832, a ruthless tyrant, left to reduce the Indians of the Pampa;

In half a century the country made little progress. Few immigrants came; trade in animal products, the chief source of wealth, increased very slowly, though animals continued to multiply and Southdown sheep were introduced in 1825. The population of the nation increased from 900,000 in 1800 to only 1,200,000 in 1852.[10] Though bordering on the sea, the region did not reap the advantage of that location. The absence of navigable streams on the Pampa, the poor roads over the wet deep soils without stones helped to keep the nation dependent on pastoral activities. Indians continued undisputed masters of vast areas. Thus in the middle of the nineteenth century economic conditions and the social order of things in the various sections of the nation differed little from those surrounding the irrigated oases and the pastoral colonies established nearly three centuries before.

MODERN ARGENTINA

Following 1852 many new forces released Argentina from the shackles causing long stagnation. These forces included the settlement of internal political troubles, the campaign against the Indians, the improvement of transportation, immigration, external changes that created a market for the surplus of Argentina, the evolution of the grazing industry and the introduction of crop production.

The banishment of Rosas, the advent of Urquiza and the drafting of the Federal Constitution gave birth to the real Argentine. Through the long years of strife provinces had suffered severely. Corrientes was almost a desert; Indians roamed up to the gates of Santa Fé and at times almost to Buenos Aires, and the western provinces were isolated and stagnant. This new lease of life opened the way for the developments that followed.

Always a menace to settlers, the nomadic and warlike Indians of

Balcarce	1832–1835, a man of straw and a puppet of Rosas; removed by Rosas;
Rosas	1835–1852, a ruthless dictator and murderer; first campaigns against the Indians; the reign of terror; defeated in battle after three attempts by Urquiza; exiled;
Urquiza	1853–1859, completed his term, a leader in the Constituent Congress which drew up the first Federal Constitution, May 1, 1853.
Durqui	1859–1861, driven out of the capital and defeated;
Mitre	1861–1868, occupied in War with Paraguay and with rebellions;
Sarmiento	1868–1874, peacefully elected while Mitre was away at war; inaugurated the era of Modern Argentina.

[10] In the same time the population of the United States mounted from 5,308,000 to 23,200,000.

the plains continued depredations on animal and man. From a line of forts to the southwest of the Paraná and along Rio Salado in 1850, the fighting Indians were pushed back step by step. In thirty years they had been swept from the Pampa, the southern Chaco, much of Mesopotamia, and Patagonia had been annexed, opening up a vast territory for the herder and the farmer and making communication feasible (Fig. 131). As soon as the Indians were cleared from the Pampa, the land was parcelled out in vast holdings to influential persons, a move that has affected all lines of development.[11]

Close on the heels of confederation the Paraná was opened in 1854 to the commerce of all nations. With Indians out of the way and free navigable waters, the all-important rail lines began to pierce the Pampa from Buenos Aires, Paraná, Santa Fé and later Bahía Blanca. Though lack of forests, ballast, shortage of labor, and the necessity of importing all supplies and fuel hindered rail construction, in a quarter of a century after the first lines started, railways had reached the margins of the Pampa in all directions; lines had connected Mendoza, Córdoba, Tucumán and Salta with ocean ports, and a line had crossed Entre Rios and Corrientes. Level terrain, absence of valleys and streams, mild climate and absence of heavy vegetation favored this phenomenal expansion as did the mounting volume of freight.

Clearing the Pampa of Indian depredations and the construction of railroads accompanied the first great Argentine immigration.[12] The influx of several thousand English, Irish and Scotch herders around the middle of the century preceded a flow of immigrants from southern Europe that has profoundly affected all Argentina—the Pampa, Patagonia and even the West. They laid the foundations of the grazing industry of Patagonia, were instrumental in bringing about improvements in the grazing industry of the Pampa and Entre Rios, and were basic to crop production, both in the permanent supply of

[11] The establishment of the *latifundia* first began on a large scale during Rosas' first campaign against the Indians in the eastern part of the Pampa. Before immigrants began to arrive all the land was held in vast *estancias*.

[12] Argentina began its independence with a small population, about 900,000. Before independence there was practically no immigration; the Spaniards prohibited it. Even natives of Spain had trouble in procuring licenses to come to America. The city of Buenos Aires received only 200 foreigners from 1770 to 1810. Proclaimed as the pressing need of the country at independence, immigration did not ensue. Despotic rule, revolutions, and attractions elsewhere kept foreigners out.

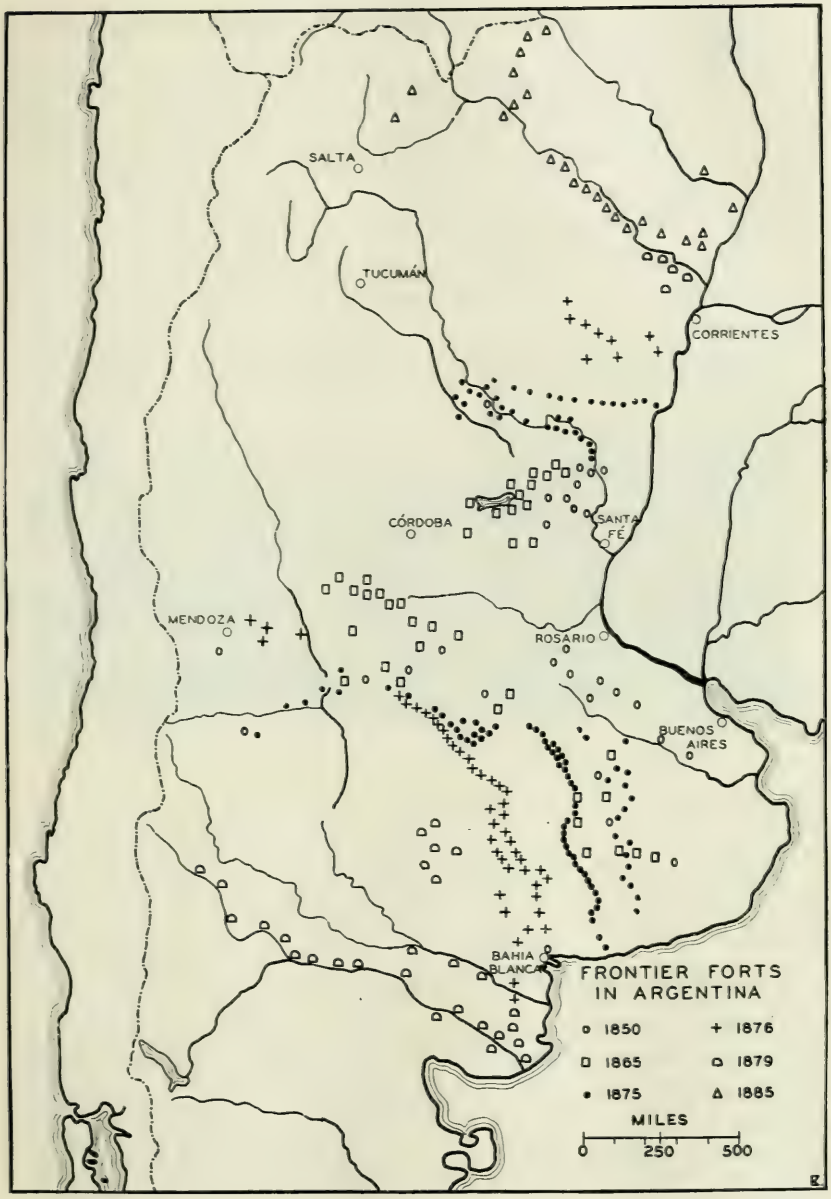

FIG. 131

The Indian forts established in the Argentine plains, since the beginning of agricultural expansion, show in a striking manner the various steps by which the cattleman and agriculturist in central Argentina were protected from the Indians. From a line

farm labor they provided and in the great swallow migration of harvest hands (Fig. 132).

As external conditions favored immigration, they also aided the improvement of the grazing industry and the invasion of the Pampa by crops. The Civil War in the United States allowed a greater market in Europe for Argentine products. The industrialization of Europe called for more and more of the commodities Argentina could supply. The introduction of refrigeration in Argentina in 1877 by the steamship *La Frigorifique* made it possible for Argentina to realize upon one of her great assets—the pastures of the Pampa. The enormous development of agricultural machinery of all types with

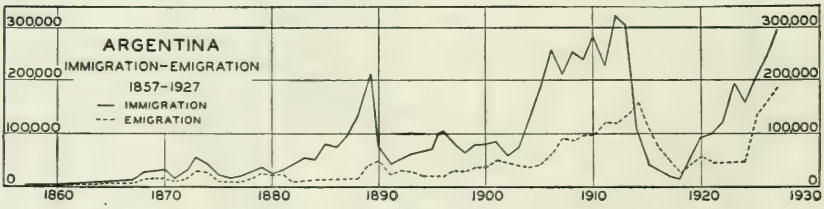

FIG. 132

Since 1857 the stream of immigrants entering the Pampa has been a significant force in bringing vast areas into production. (Resumen estadístico del movimiento migratorio en la República Argentina, años 1857–1924, Direccion Gen. de Immigración, Buenos Aires, 1925.)

interchangeable parts opened the way for the tillage of the land, previously utilizable only by the numerous herds and flocks.

Within Argentina, the animal industry witnessed a complete evolution. Water was provided for the herds and flocks; ranges fenced; breeding regulated; pure-bred stock introduced by the thousands; measures taken to control the ravages of the tick; slaughtering and

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a short distance west of Rio Paraná in 1850, the armies and frontier posts advanced to the Rio Negro and beyond on the south and to Rios Bermejo and Pilcomayo on the north. (Sources: Map of A. Petermann in W. Parish, Buenos Aires, and the Provinces of the Rio de la Plata, London, 1852; A. von Seelstrang and A. Tourmente, Mapa de la República Argentina. 1:4,000,000, Buenos Aires, 1875; DeMoussy, Atlas of the Confederation, Argentina, Buenos Aires, 1873; Die argentinischen Territorien der Pampa, etc., nach den Aufnahmen der Expeditions-corps des General Roca. 1:4,000,000, *Petermanns Mitteilingen*, Vol. 27, pl. 5, Gotha, 1881; F. Host and J. Rittersbacher, Karte der Militargrenze am Rio Neuquen. 1:1,000,000, *Zeitschrift der Gesellschaft für Erdkunde*, Vol. 17, pl. 2, Berlin, 1882; J. Rohde and S. Quiroz, Karte des argentinischen Chaco. 1:2,500,000, ibid., Vol. 21, pl. 1, Berlin, 1886; Luis Brackebusch, Mapa de la República Argentina. 1:1,000,000 Gotha, 1891.)

chilling plants constructed; and, most significant of all, alfalfa ranges established on most every *estancia*. Consequently, frozen and chilled meats replaced in trade the live cattle, shipped with difficulty, and *tasajo*, a staple product for centuries (Fig. 133). Sheep carcasses, formerly left for dogs and buzzards or rendered into tallow, likewise entered trade in the form of mutton. Of course, wool, hides, and hair continued to move in great volume. With ocean transport, railways, immigration and machinery the production of cereals for exports staged a more remarkable advance than the animal industries in

Fig. 133. Pure Bred Cattle, Buenos Aires Province

Young high-grade cattle grazed on alfalfa from the time they are calves dress into first-class chilled beef for the markets of the United Kingdom, which takes 95 to 98 per cent of the total exports of this grade of meat.

response to favorable environmental conditions on the Pampa and increased demands in Europe. Wheat, corn, and flax began to carve great slices out of the vast grazing domain.

All these currents elevated Argentina in a relative brief period of years from a secondary position among South American countries to first rank in the continent and in the southern hemisphere and to the leading agricultural surplus area of foodstuffs and raw industrial materials in the world. They threw into bold relief: Mesopotamia with sheep, cattle and *yerba maté;* the Chaco with quebracho, cattle and cotton; the Arid West with sugar, wine and goats; Patagonia with sheep, cattle, forests and oil; and the Pampa with beef, wool, wheat, flax, oats, corn, and swine.

CHAPTER XXII

THE ARGENTINE MESOPOTAMIA

As the most abundantly watered area of the country, and thereby that section supporting the greatest stands of subtropical vegetation, the Argentine Mesopotamia holds a distinctive place among the natural regions of Argentina. From the swampy shores of the lower Paraná to its northeastern extension between Paraguay and Brazil, the region embraces some 74,000 square miles, most of which clearly displays the effects of interfluvial location. Despite the comparative ease of transportation, the land bounded by the Paraná and Uruguay Rivers constitutes one of the less-developed portions of Argentina. Thousands of square miles in Corrientes lie unexplored, while the upland of Misiones persists as a district of notably scant population. On the whole, however, the Argentine Mesopotamia has considerable present and potential significance, both as a grazing and crop-producing land in Entre Rios, much of Corrientes, and southwestern Misiones, as a valuable source of wood for the populous but treeless Pampa, and as a source of valuable hydro-electrical energy.

In certain respects the facilities afforded by its great water highways have retarded regional advance, though at the same time the rivers have contributed much to whatever economic status the land has attained. While the ease of transport aided the early rise of cattle and sheep industries, chiefly in Entre Rios, the same ease permitted penetration of more interior lands where areas of greater attractiveness held the newcomer. The one important railroad has for its objective Asunción, in Paraguay, rather than any of the Argentine towns. Conditions of climate and soil augment the effects of the rivers, with the result that Mesopotamia supports slightly more than one-half million people having a considerable proportion of Indian blood. Corrientes is the most Indian of the Argentina provinces; major centers have developed at Paraná, Corrientes, and Posadas,

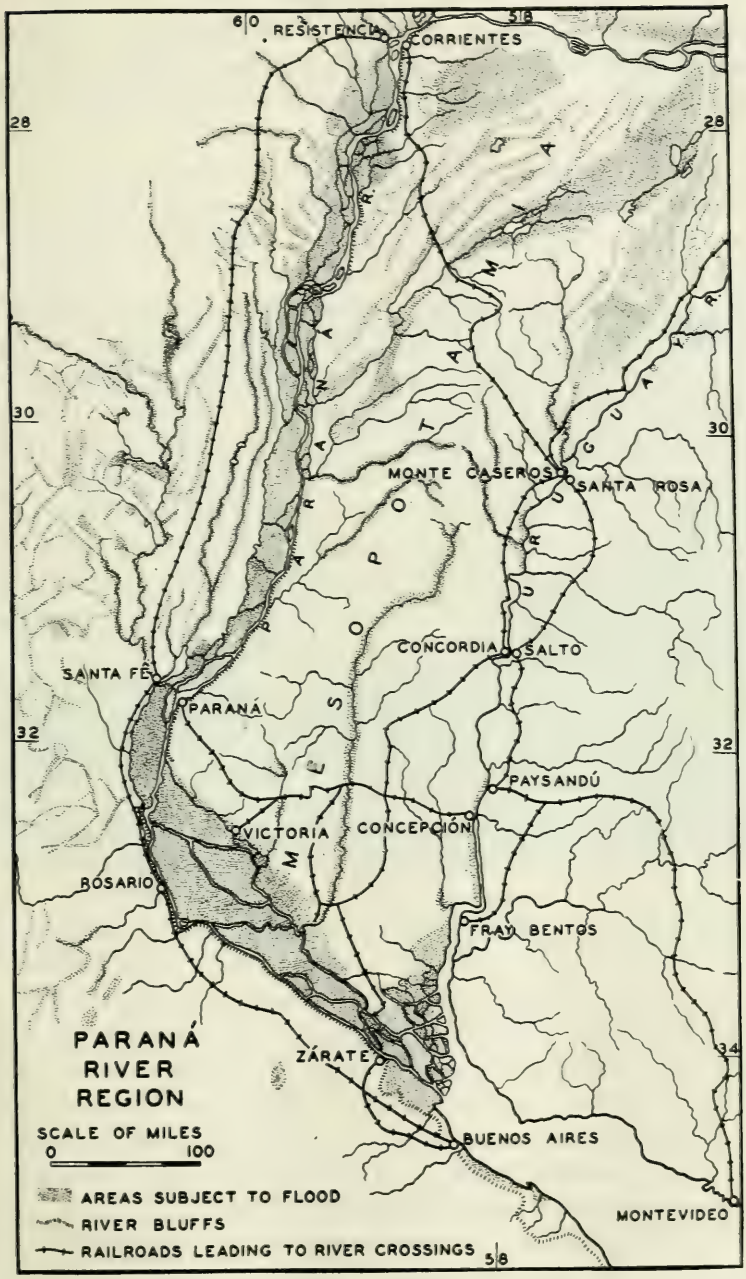

FIG. 134

(Based on Mapa de los ferrocarriles de la República Argentina by Dr. Jose Chavanne, 1:1,000,000 Dirección de Ferrocarriles Nacionales, Buenos Aires, 1892.)

river towns and capitals respectively of Entre Rios, Corrientes and Misiones. In Misiones a recent colonization by agricultural German-Brazilians has introduced a new and valuable element of population.

PHYSICAL SETTING

Though uniformity prevails with respect to sparsity of settlement, the Argentine Mesopotamia consists of three well-defined zones, differentiated primarily on the basis of relief and to a large degree as well on the basis of soils and vegetation. These zones may be designated as (1) the rolling lands of northern Entre Rios and southern Corrientes, (2) the alluvial areas of most of Corrientes and southern Entre Rios, and (3) the highland of Misiones (Fig. 134).

Climatically, the region displays features separating the land from the bulk of Argentina. For the entire area, rainfall exceeds that for any other section of equal size in the country. With a well-marked, though not dangerous, winter minimum, rains increase uniformly from less than 40 inches at the south to more than 60 inches at the northeast. In the northern lowlands, high temperatures and the high humidity make living conditions unattractive, but the cooler lands of the south and those of highland Misiones enjoy a rather healthful climate. On the whole, however, the various districts of Mesopotamia are separated rather by conditions of relief, soils, and drainage than by climate.

In contrast to æolian clays and silts on the right bank of the Paraná, fluvial deposits of clays, silts and sands cover the greater part of Mesopotamia. Running waters have formed the rolling landscape and carved out secondary valleys, everywhere pleasant to the eye in contrast to the monotonous expanse of the Pampa. The undulating lands of southern Mesopotamia afford a landscape resembling that of parts of Texas and Oklahoma (Fig. 135). Soils include relatively fertile, well-drained, loamy types plentifully supplied with humus. A large part of the land supports a growth of grass similar to that of the Pampa, though far less continuous, owing to the strips of *Mimosa*, notably the *ñandubay* (*Prosopis ñandubay*), which live in the valleys. In spots, tree growth expands into a solid forest.

The alluvial plains of the south and north consist essentially of a flat lowland of sands and clays, interrupted repeatedly by great marshes. The most extensive of the marshes, the Laguna de Ibero,

embraces a considerable portion of the province of Corrientes, possibly 10,000 square miles. In general, these lands support grasses like those of the hills to the south, here and there showing stands of the *ñandubay*, but more commonly the tree growth is that of isolate groups of conspicuous palms—the *caranday* (*Copernicia cerifera*), on wet clay soils, and the *yatay* (*Cocos yatay*) on sands. In addition, the lagoons display tangles of rank luxuriance on floating mats of

FIG. 135. ROLLING LANDS OF ENTRE RIOS

A fertile land awaiting the time when greater demands for foodstuffs will bring railways, machinery, and population to Mesopotamia to convert the prairies into a granary.

vegetation, while portions of the west have stands of quebracho and associated Chaco forms in the better-drained districts. A part of the highlands of South Brazil, this district, a much-dissected sandstone plateau, rises progressively towards the northeast to an elevation of more than 2,500 feet. In parts, decomposed basalts afford a rich red soil of astonishing depth. Forests dominate the lands of Misiones, although in the southwest strips of grassland provide the transition from the Corrientes country. Below some 2,000 feet a forest of great variety and wealth in subtropical timbers and brush like that of the Paraguayan territory covers the land; here the most

utilized tree is the *cedro* (*Cedrela brasiliensis*); on the heights of the plateau extend the valuable growths of Paraná pine (*Araucaria brasiliana*). At the lower margins of the pine forest lie the natural and planted *yerba maté* stands, the leading commercial element of the forests of Argentine Mesopotamia.

AGRICULTURAL DEVELOPMENT

Notwithstanding the low stage of development of the Mesopotamian lands, their agriculture holds considerable importance. Though the raising of livestock dominates agricultural occupation, the region possesses varied wealth in other activities. Grains, chiefly corn, tobacco, peanuts, and fruits occupy a comparatively large acreage, but the principal crop, evolved from a purely forest industry, is *yerba maté*.

The grazing of cattle encounters a number of hindrances which result in a rather primitive status for the industry as a whole. Nevertheless, the abundance of grasses and water, and in early days especially the cheap water transportation account for large herds. Corrientes alone has almost 4,000,000 cattle, 2 head of cattle for each person (1914), while Entre Rios had 5.5 and Buenos Aires 4.4. Wide of horn, huge and bony of frame, the native stock at 5 or 6 years of age goes from the north to the salting works established principally on the Uruguay River, and from the southwest to the packing plant at Rosario on the Paraná. Improvement of the herds proceeds slowly, chiefly owing to the ravages of the tick. So serious a menace is the tick that the Argentine government strictly limits the exchange of cattle between the lands south of the Paraná River and those of Mesopotamia. Numerous dipping tanks are maintained in southern Entre Rios. Other handicaps to great progress comprise the grasses which are of no particular excellence except for their abundance, and the ease of producing, marketing, and improving livestock in more favored portions of Argentina (Fig. 136).

The factors which facilitated the rise of an early cattle industry had a like effect upon the raising of sheep in these lands. The flocks graze principally in the southeast, for the wet lands of the north and west are unfavorable. With some 5,000,000 sheep, Mesopotamia embraces one of the three leading sheep regions and produces much of the wool of Argentina. As has been the case in the Pampa, the

gradual growth of agriculture in the south restricts the industry, so that the ultimate refuge for Argentine sheep will be Patagonia and arid Western Argentina.

Accompanying the grazing industries, tillage of the land has slowly developed and promises little for some time because of the gradual growth of population in the region. Subsistence agriculture prevails. Crops include mandioca, peanuts, sugar-cane, and various fruits. Mandioca and peanuts are important elements of daily diet, the

FIG. 136. AN ISLAND HOME IN THE PARANÁ RIVER

Many large, low, flat islands, supporting some good savannas, are utilized every season for fattening cattle and as way stations for cattle being shipped from up-river points to the packing plant at Rosario; note cattle pen on left.

former being grown in the warmer moister lands of Corrientes and in the forest clearings of Misiones, the latter in southern Corrientes producing one-third of the Argentine crop, but its annual value is far less than that yielded by the green glossy leaves of *yerba maté*.

The *yerba maté* industry acquires considerable importance as a result of favoring physical conditions. The red soils of three meters depth and moist but well drained are the only ones in which *yerba maté* does well. These are found on the slopes of the hills below the Paraná pine zone but well above the river flats of the flood plains (Fig. 137). Forty to sixty inches of rain well distributed through the year, high humidity and at the same time much sunshine, the direct rays of which are broken by shade trees for the young plants, favor the growth of the tree. To start the *yerba maté* groves, the seed

generally is planted in the forest, for the delicate young tree requires shelter from the hot sun. As the tree becomes larger and stronger, some of the forest growth is cut and the underbrush removed. Assisted by the wide distribution of *yerba* in its natural habitat, establishment

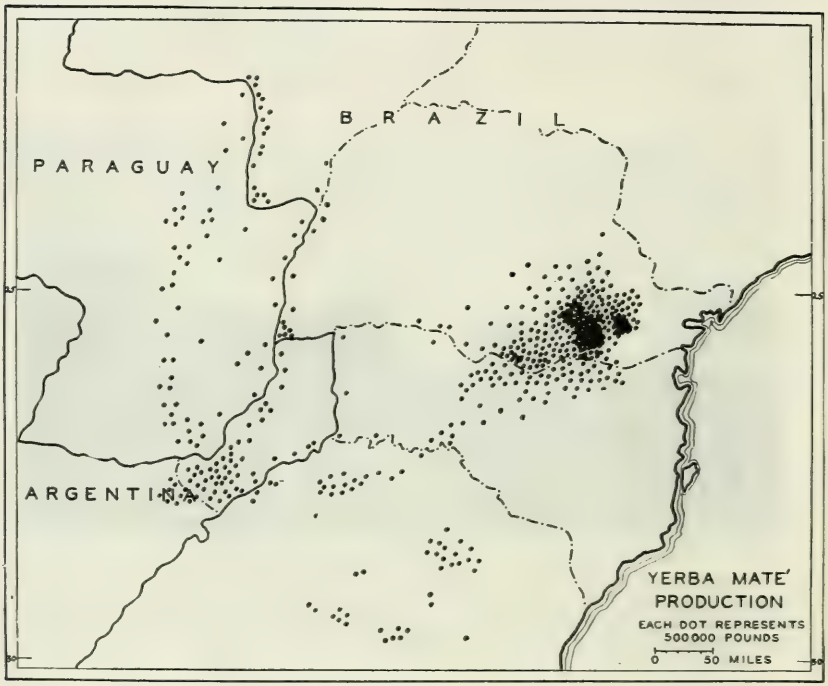

FIG. 137

The production of *yerba maté* in Brazil, Paraguay and Argentina. (Sources: Brazil, *Recenseamento do Brazil*, 1920, Vol. III (*2a parte*), pp. 364 ff., *Agricultura*, Directoria Geral de Estadística, Rio de Janeiro, 1925; Paraguay, *Anuario Estadística*, 1917, p. 155, *República del Paraguay*, Imprenta Nacional, 1922; Argentina, *Cartilla del Cultivo de la Yerba Maté*, Ministerio de Agricultura, Sección Propaganda é Informes, pp. 1–32, Buenos Aires, 1926, and *Mapa Cultivas y producción*, Ministerio de Agricultura de la Nación, Buenos Aires, 1927.)

of plantations has progressed on a large scale; in 1928, the area in *yerba maté* was 82,000 acres, with a production of 45,000,000 pounds; 15,000 laborers were employed. Most of the product goes to Posadas, which also handles much of the harvest by Brazilians and Paraguayans, and thence to the consuming centers of Argentina. The efforts of the country to make itself independent of Brazil and

Paraguay with respect to its large consumption of *yerba maté* promises an era of expansion for Misiones and the lands of Corrientes which produce the beverage.

THE FOREST INDUSTRIES

Except for an exploitation of short duration in the quebracho growths of western Corrientes, which ended with the exhaustion of the small stand available, the forest industries of Mesopotamia have been confined in the main to Misiones. Since the nineteenth century, when Jesuit priests established the mission, from which the territory Misiones derived its name, the resources of the forest have been utilized, notably with respect to *yerba maté,* although this has become dominantly a cultivated crop in late years. Timbers have undergone little cutting, as yet the pine forests lie too far from the rivers to enable profitable development. The *cedro,* a lowland tree near the rivers, has provided the most easily worked tree, because of the excellence of its wood and the fact that, in contrast to many other local timbers, the wood is easily worked and floats.

For Argentina of the distant future, the wealth of Mesopotamia constitutes a valuable resource, but for Argentina of the next few decades the land remains a thinly settled region of scrubby cattle and sheep, of small-scale cultivation of crops, of large reserves of water power distant from the center of the country, and of one bright spot of considerable activity—the *yerba maté* district. While the great plains of the Pampa remain utilized only to a small portion of their capacity, Mesopotamia can expect little advance. It will continue a relatively backward inter-stream area, a land in which the features characterizing certain insular territories clearly affect the scope of human activities.

CHAPTER XXIII

THE ARGENTINE CHACO

Of the low plains of Argentina, the Chaco remains least developed and least known. Over much of an area of some 150,000 square miles yet roam Indian tribes not in the least fettered by any advance of white dominion. Only in favored spots, particularly in the southeast and near the Paraná and Paraguay Rivers, has colonization been effected (Fig. 138). In these areas, however, two important industries have arisen, each more significant in the Chaco than in any other portion of the country. The earlier and greater of these activities concerns the production of quebracho, the leading forest enterprise of Argentina, while a new and rapidly growing agricultural district has arisen in southern Chaco territory with cotton as a basis. A third occupation, cattle-raising, promises greater development, but in the main this industry bears the brunt of most of the serious handicaps of the Chaco.

A comprehensive array, the problems besetting expansion within the Chaco comprise: isolation, difficulty of internal communication owing to physical and human conditions, poverty of water, numerous diseases, the tick, the locust, rapacious animals, poisonous snakes, and hostile Indians. Naturally, Argentina turns to a further advance of its favored Pampa rather than to perilous pioneering in the Chaco. Nevertheless, settlement gains momentum in response to beckoning expanses of fertile soils, vast grasslands, productive warmth and in association with exploitation of quebracho.

Population has gradually advanced from west, south, and east, but on the whole the Argentine Chaco will long remain a region of notably sparse population. Penetration occurred first along the western margins, where cattle herders from the northwestern oases took advantage of the Chaco grasses. On the east, quebracho has caused the primary major grouping of settlement, for here the great river highways give access to Buenos Aires and the sea. Here lie the principal towns: Resistencia, capital of the territory of the Chaco, with a

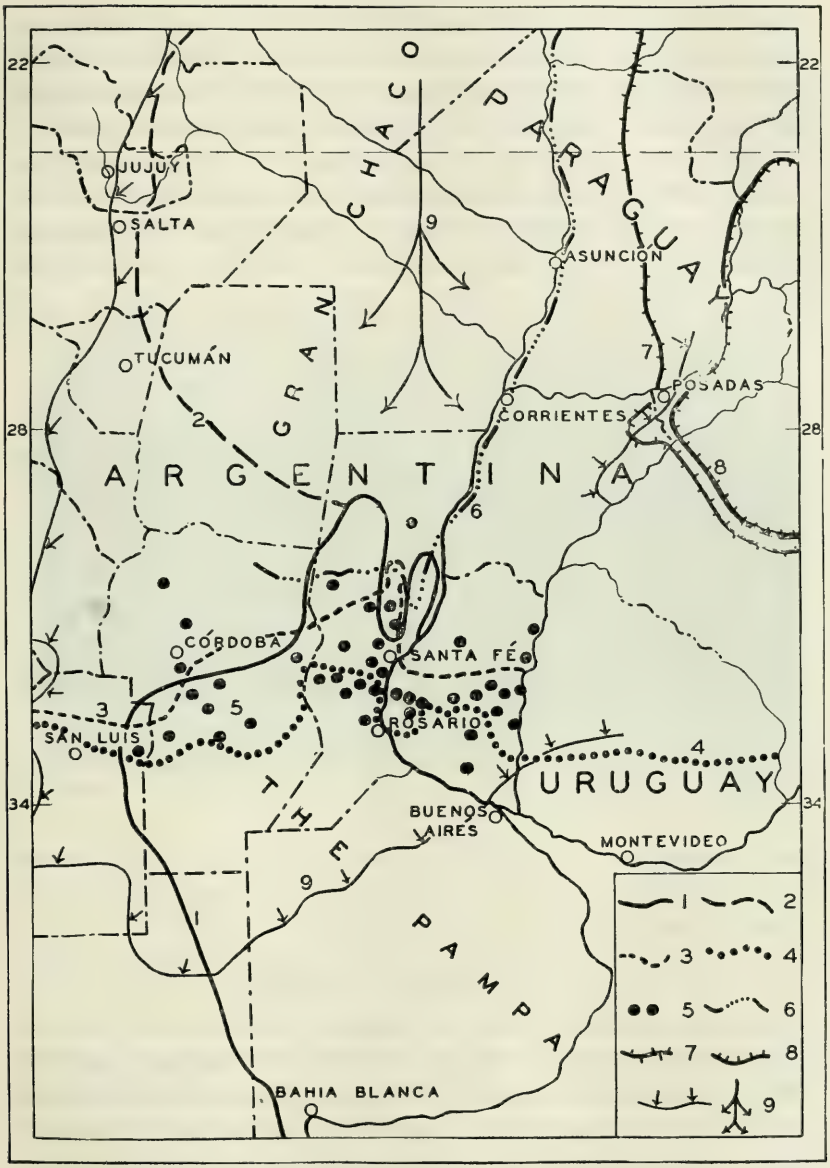

FIG. 138. THE ARGENTINE CHACO AND ADJACENT LANDS

(1) Border of Pampa (after Pierre Denis), (2) southwestern border of Gran Chaco, (3) limit of area where it is obligatory to dip cattle to kill ticks, (4) southern limit of tick infestation, (5) public disinfectant dipping tanks for killing ticks, (6) southeastern limit of quebracho, (7) southwestern limit of *yerba maté*, (8) southwestern limit of the Paraná pine, (9) southwestern limit of locust migration in 1924–25. The arrow at (9) indicates the direction of migration.

population of 12,550; Formosa, capital of the territory of Formosa, population 10,000. These two towns hold one-fourth the combined population of the 94,000 square miles embraced in the territories of El Chaco and Formosa. A government railroad across southern El Chaco territory and the consequent growth of population in the "cotton belt" of Argentina have occasioned a more recent center of settlement in the Chaco. In addition, along the southern borders of the region, colonization has pushed into the land as removal of the

FIG. 139. FLAT COUNTRY NORTHWEST OF SANTA FÉ

After heavy rains great expanses of the country are covered with water a few inches in depth; in the distance on a slight rise of ground stands the *estancia* headquarters; the conditions after a big rain on April 24, 1925.

forests progresses. The north, along the barely known course of the Pilcomayo River, continues pre-eminently the domain of the intractable Indian.

PHYSICAL CHARACTERISTICS

Like the contiguous lands of Paraguay, the Argentine Chaco is essentially a low-lying country of little elevation and less relief (Fig. 139). As a result, large areas lie in swamp, interspersed here and there with the slight rises which provide refuge for stock at times of high water. In contrast to the uniformity of relief, soils display considerable diversity owing both to varying distance from the rivers which build up the land and the nature of underground drainage. Over large tracts, strata of hardened clays explain the existence of swamp land; saline soils add to the lands excluded from easy agricul-

tural development. Because of the adversity of both soil conditions and the seasonal distribution of rains, a permanent supply of potable water becomes the chief concern of all human activity in the region. The larger part of the region, chiefly the west, finds only saline waters in wells drilled to even exceptional depths.

The subtropical climate of the Argentine Chaco plays a leading part in rendering the area repellent to settlers. For much of the region, the winter dry season which is reflected in the savanna vegetation constitutes a grave menace. With a gradual gradation, rains

FIG. 140. THE CHACO NEAR RIO BERMEJO

Tall Chaco grasses in the foreground; gallery forests and the tall *Pindo* palm along the water course; the leaves of this palm are good feed for cattle; the fruit is eaten by the natives.

increase from 20 inches annually on the west to more than 50 inches on the northeast, most of the land receiving between 25 and 40 inches, an amount sufficient for active settlement if seasonal quotas and temperatures permitted. As it is, in winter the lands experience a pronounced period of drought, even the extreme eastern margins registering less than one-tenth of their annual rainfall in the quarter June-July-August. Summer brings rain, but at the same time elevated temperatures, so that the rainy season is decidedly unpleasant; violent thunderstorms are frequent. In addition to the warmth of plains at low elevations in latitudes 22° S. to 29° S., the region swelters under the influence of enervating prevailingly northerly winds. The mean summer temperature for most of the region averages above 77° F.

Natural vegetation shows unusual lack of uniformity. No single term embraces all of the elements of the regional plant life. To the effects of climate in causing the growth of varied types are added the manifold differences of soils and drainage. The Argentine Chaco consists of true forest, true prairies, great swamps, and every degree of relationship among the plant groups. Succeeding one another at varying intervals extend lands of scrubby brush, patches and strips of tall grasses, palm groves, true forests, and swamps. At the west, the *algarroba* (*Prosopis blanca* and *negra*) provides greatest economic utility as timber and as a source of food. The *caranday* palms, like those of Mesopotamia, dominate the palm groves (Fig. 140). The third arborescent group of the Chaco, the quebracho forest, is the most valuable forest resource of Argentina.

THE QUEBRACHO INDUSTRY

Localized principally in a strip near the Paraná and Paraguay Rivers, because of the need for cheap water transportation as well as because of the location of the better stands, the quebracho industry supplies the bulk of the most important source of tannin extract in the world. As in Paraguay, Argentina's exports of quebracho extract and quebracho logs constitute a significant item in its foreign trade, the value of shipments in some years exceeding $20,000,000. In addition, the poorer forms of quebracho supply an important domestic market for railway ties and fence posts.

The exploitation of quebracho began in 1850, a century after the first exportation of timber from the Paraná country. In a short time, two divisions of the industry appeared. The more open stands of the west supported the quebracho *santiagueño*, a form which contains 10 per cent of tannic acid. Since the quebracho *chaqueño* of the eastern river districts contains 25 per cent of tannic acid, the early split in industry developed, the former being cut primarily for timber, the latter for tannic acid. The industries of the interior belong to a number of small capitalists, who purchase logs in small quantities. In contrast, the tannic acid factories of eastern Chaco are large permanent establishments importing quantities of logs from long distances. The relative abundance of fresh underground water, a prime necessity for the preparation of extract, and the cheap shipping facilities on the rivers restrict the sites of these factories to a strip near

the Paraná and the Paraguay. Labor for the factories comes from Corrientes across the Paraná, while the less attractive sawmill enterprises of Santiago del Estero must recruit a working force from the interior agricultural districts.[1]

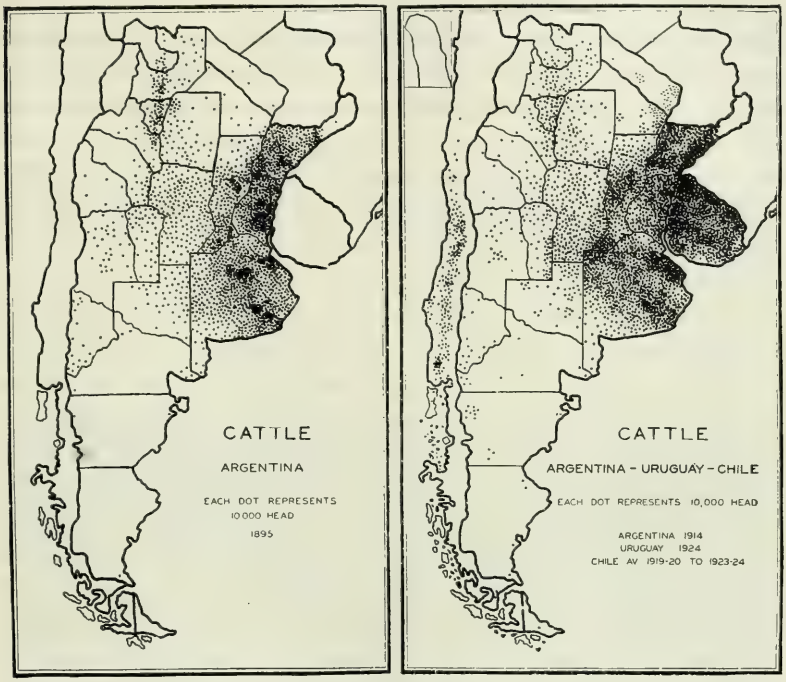

FIG. 141. THE DISTRIBUTION OF CATTLE IN ARGENTINA, URUGUAY, AND CHILE

Though the cattle industry is one of long standing in the Chaco, it has not begun to advance as it has in the Pampa or even in Mesopotamia and Uruguay; on the two maps note the increase in central Santa Fé, Corrientes and Buenos Aires.

The industry has developed at a rapid rate since the first important shipments. At present the annual cut totals more than 1,000,000 tons of quebracho logs, cut from about 500,000 acres. Recent estimates place the life of the industry at about 40 years at the present rate of exploitation. These fail to take into account the working of lower and lower grade materials as tannin extract becomes more expensive. Present methods employ only the heartwood, which yields some 25 per cent of tannin. Sapwood, yielding 3 to 4 per cent of

[1] See Chapter XX for a more extended treatment of the physical and economic conditions of the quebracho industry and for the export statistics of Argentina.

tannin, and bark, giving 6 to 8 per cent, are discarded. Furthermore, the institution of a forest policy may lengthen materially the life of the industry.

THE LIVESTOCK INDUSTRY

In contrast to the recency of the quebracho industry, the grazing of animals in the Chaco is of long standing (Fig. 141). Indians have grazed cattle and horses in the Chaco since the seventeenth century. Finding forage fairly plentiful, the early pastoral colonizers of the west supplied numbers of cattle to the oases and in addition drove quantities across the Andes to north Chile. The forested sections of the eastern Chaco also have many cattle, used in part for local consumption, but primarily as draft animals.

The several handicaps of the land prevent a significant development of the grazing industry. First, the Chaco is remote and lacks transportation facilities. The grasses, green and tender at the beginning of the rainy season, soon become tall, hard, and of decreasing value as the dry season nears. The whole area lies in a tick zone, so that only hardy but inferior cattle can be raised (Fig. 142). The hoof-and-mouth disease is endemic; blow fly causes a high mortality among calves. In vast areas a scarcity of water exists at times during the dry season, as stream courses dry up or as pools of water become too brackish for drinking purposes. Few ranges are fenced as on the Pampa, and little is done to regulate breeding or to improve the herds. In recent years, however, the extreme southern zones in northern Santa Fé have produced an improved cattle industry based on alfalfa range and indicate significant trends for much of the region.

CULTIVATION OF LAND

With respect to crop production, the Chaco has less promise than for pastoral development or for the quebracho industry. In general, agricultural settlement does not follow removal of quebracho, for natural conditions do not tempt the establishment of permanent groups of population. Temperature, rainfall, relief, soil, and drainage locally may favor the production of a wide range of subtropical crops. Nevertheless the region can produce little for some time because of small population, restricted market at the cattle *estancias*, or the extract plants, poor transportation facilities and ports, and unfavorable natural conditions over vast areas. Augmenting the list of

difficulties is the fact that nearly every year, from November to February, a plague of locusts arrives, the rapacious insects devouring field crops, garden truck, the young grasses, and even the leaves of trees. The first swarm of locusts (*Schistocerca paranensis*) consists of "fliers" that fly in considerable numbers, and lay eggs; in about 10 days the fliers have disappeared and the vegetation looks fairly well. In three weeks the eggs hatch out billions of "hoppers," with voracious appetites. Few plants escape them; they do not eat the *Paraiso*

Fig. 142. Cattle Dip at Arrufo, Santa Fé

Before cattle can be shipped from the tick-infested zone of the Chaco into the Pampa, they must be driven through the dipping tanks containing an arsenic solution two or three times in order to kill the ticks—see Fig. 138.

tree even though they roost on it; they do little damage to the eucalyptus if there are other things to eat; the leaves and vines of cucumbers, watermelons, and pumpkins are devoured but not the fruits. Often the plague arrives too late to do great damage to wheat and linseed. Alfalfa, always eaten to the ground, soon springs up again. Corn, soft and tender, is ruined when a marching host enters a field.

Despite these several handicaps two zones of crop production have materialized. The earlier of these comprises a strip some 20 miles in

width along the Paraguay and the Paraná, where the concentration of population along the fluvial thoroughfares has given rise to diverse cultures of subtropical as well as temperate crops. The second zone consists of an almost uninterrupted series of settlements along the

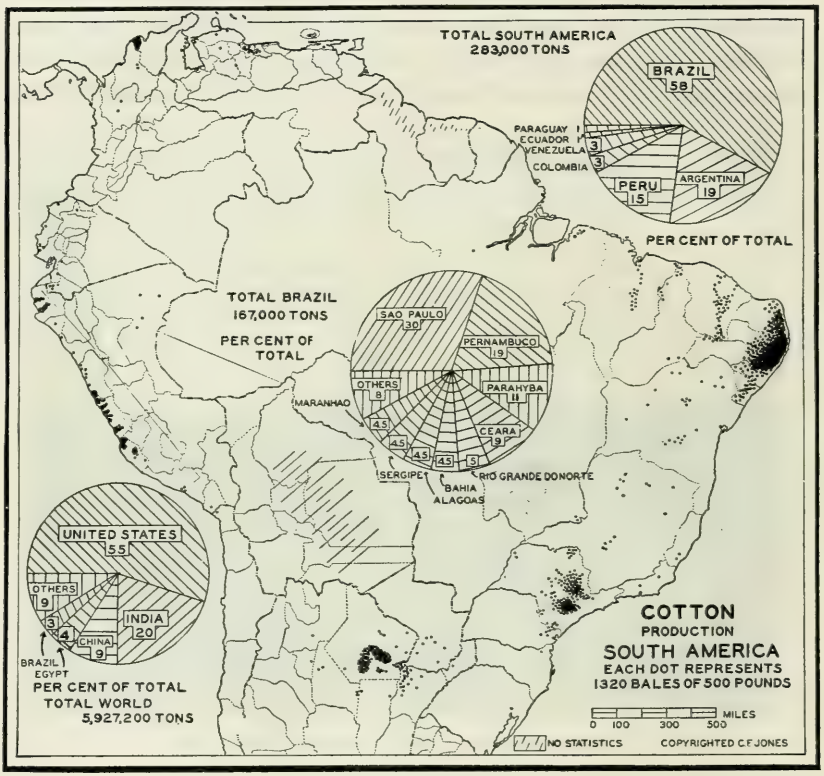

Fig. 143

Of the five chief cotton regions of South America the Chaco is one of the newest; the location of the district shows the influence of rail transport.

government railway from Resistencia westward, where agricultural progress bears promise of a new era of enhanced significance for at least the southern Chaco. Here "cotton is king."

The Cotton District.—The cultivation of cotton on an important scale in the Chaco is of recent development and has been fostered greatly by the Argentine government (Fig. 143). In addition to having provided the vital rail artery, the federal interests have aided the

industry in many ways, for the country considers cotton the one great crop of the future for the Chaco. Agencies distribute free seed that has been carefully selected and treated. Local branches of the Bank of the Nation extend loans to farmers. Travelling experts teach the newcomers modern methods of cultivation and picking. Dissemination of government pamphlets is in effect on a large scale. Every effort is made to induce immigrants to settle in the area for here they

FIG. 144. LOCUST SHEET IRON BARRIER AND DITCH

One of the methods of combating a locust advance consists of erecting a "V"-shaped sheet-iron barrier with a long ditch leading back from the center of the "V"; when the trench becomes filled with the hoppers they are set on fire after kerosene is sprinkled over them—see Fig. 138 for the extent of the migration of 1924–25. (*Courtesy of H. G. Olds.*)

may secure government land at a nominal fee. In addition, the various bureaus have taken steps to introduce better varieties of cotton and to grade the crops.

Handicaps abound. Locusts by the millions swarm southward across parts of the area and not infrequently make a clean sweep of the early stands, making replanting necessary, with the consequent danger from early fall frosts; cotton fields are protected from the invasions by sheet-iron barriers and ditches, in cases provided by the national government (Fig. 144). The leaf worm causes considerable widespread damage; cotton wilt has appeared; ants are a nuisance. Most serious of the pests is the pink boll weevil, which as yet has

affected only small districts. A further major deterrent consists of the ignorance of immigrant farmers in regard to the needs of the industry.

Though portions of the north of Argentina have produced cotton for centuries, significant expansion began in 1900. Subsequently the increase in acreage has rapidly progressed; in 1928 the crop occupied 210,000 acres.

The cotton cultivated is a hybrid of upland American and Sea-Island. Though of excellent texture, fibers vary considerably in length; 40 per cent of them are between $\frac{5}{8}$ and $\frac{7}{8}$ of an inch; 35 per cent, 1 inch; 25 per cent between 1 and $1\frac{1}{8}$ inches. Yields average high, at times 40 per cent greater than those of the United States, but much of the baled product enters trade channels dirty and discolored.

Unlike most of the crops of Argentina, production by the small farmer rules. Planter, his family, and only occasional help care for the majority of farms, although on a few large plantations imported labor becomes necessary. During the picking season some 25,000 Indians migrate to the cotton fields.

THE PROSPECT

The Argentine Chaco holds great potentiality for future development, but its possible rise to a significance approaching that of regions of comparable extent in the peripheral portions of the continent not only will require a long stretch of years but in all probability can never materialize. Isolation, the great original barrier, becomes of less importance as a factor restricting expansion. The ravages of insects and diseases decrease under the advance of modern methods. There remains then the salient conditioning element of the Chaco environment, salient in that in itself and in its effects upon underground waters, soils, and plant life, climate minimizes to a great degree the apparent advantages of these extensive plains.

Though Argentina has entertained visions of a vast "Cotton Belt" rivalling in world importance the great wheat and corn lands of its Pampa, the Chaco holds little indication of acquiring such rank for sometime, if ever. Far more available lands of easier and greater productivity lie within the continent, notably in eastern Brazil, not to mention other potential cotton lands of the world which have more favorable access to leading markets. Domestic markets hold a

certain promise for Chaco cotton, but Argentine population increases rather slowly.

The increasing pressure of cropland on grazing territory the world over indicates an enhanced value for the cattle lands of the Chaco. While in this respect, development in the Chaco doubtlessly will surpass that of cotton for the region as a whole, no rapid advance can occur in the near future. Aside from the multiple problems affecting grazing in the Chaco, other already important and better cattle lands of South America have far to go before reaching maximum capacity or quality.

The third major activity of the Argentine Chaco, the exploitation of quebracho, will continue as the dominant industry for several decades, although the probable eventual exhaustion of the stands denotes the future waning of the forest enterprises. Moreover, the workable growths cover only a small part of the entire area.

In short, then, the Argentine Chaco continues a little known land, dominated by the quebracho industry, overesteemed though nevertheless promising as a cotton-producing area, and on its way toward its principal utility as a whole for the grazing of cattle.

CHAPTER XXIV

ARID PLAINS AND MOUNTAINS OF WESTERN ARGENTINA

Conspicuous among the characteristics of the region designated as the Arid Plains and Mountains of Western Argentina is the noteworthy uniformity of economic activity. Despite the apparent complexity of the land, these western sections of Argentina display one principal industry—grazing. Only in the favored districts composing the Irrigated Oases of Western Argentina, which by abundance of water have been separated distinctly from the region, does pastoral life lose predominance.

In its great extent embracing one-third of Argentina, the region produces comparatively little. It borders the rich lands of the Pampa and the vineyards and plantations of sugar-cane in the oases, but in the main its own territory lies barren of prosperous agricultural industry. Herein lies the Argentine desert, resembling in many respects the hot deserts of North America and in some ways constituting a far less liveable area; the Puna de Atacama, including within its confines practically all of the territory of Los Andes, ranks high among the excessively inhospitable portions of the earth's surface.

From the standpoint of population, the barrenness again becomes evident. Apart from the zones immediately adjacent to the oases, practically none of the land holds more than ten persons to the square mile. Considerable portions support less than two to the square mile; the territory of Los Andes, with an area of some 40,000 square miles, has less than 3,000 inhabitants, a density of population of less than one-tenth person to the square mile. The Salinas Grandes, despoiling La Rioja, Catamarca, Santiago del Estero, and Córdoba collectively of 7,000 square miles, also lies a tract almost totally empty of any form of life. Other portions, it is true, show much more activity. The eastern borders in La Pampa, San Luis, Córdoba, Santiago del Estero, and Santa Fé approach the utility of contiguous regions, a fact illustrating the trend toward their inevitable inclusion within

the more advanced areas. This is a small zone, however, one which affords a transition. As a whole, the Arid Plains and Mountains can develop only a low "carrying-capacity" whether for livestock or for men.

In early days the region served almost solely as a transition area between the Pampa and the lands of the oases and the neighboring countries. To be sure, parts of the northeast and of the south indicate a degree of advance, but the major rôle of the desert is that of a gap to be bridged by traffic plying between Buenos Aires and Mendoza and Chile or the East and Tucumán and Bolivia. The sections blessed with water came into service early. Mendoza was founded in 1561, San Juan in 1562, and Tucumán in 1565. The alluvial fans of the western piedmont of Argentina soon became important concentrations of population. Owing to the paucity of sizeable streams draining the arid bulks of the Andes, the worth-while sites for the growth of oases were quickly recognized, so that today, except for the expansion to come within present oases, few new agricultural districts may arise. In southern Mendoza, on the deposits of the Diamante and Atuel Rivers, lies the most recently opened area, one which promises considerable progress.

In all parts, transportation has conditioned progress. The perils of the parched desert made adequate facilities indispensable for significant development. Two principal influences caused the establishment of early routes. One concerned the need for strategic lines of communication linking the far-flung colonial settlements, the other depended upon the rise of the great trade in mules with the mines of Bolivia and Peru. The growth of the more important of these routes led to a corresponding growth in Mendoza and Tucumán particularly. These centers lie on the trunk-line railways of the region; the Buenos Aires to Pacific and the Transandine lines meeting at Mendoza City connect the Pacific and Atlantic coasts of the continent; Tucumán owes much importance to the government line from Córdoba, which now has grown into the international system affording rail movement between Buenos Aires and La Paz, Bolivia.

PHYSICAL SETTING

With reference to relief, the region surpasses all others of Argentina in heterogeneity. From the level of the sea the land rises to the great-

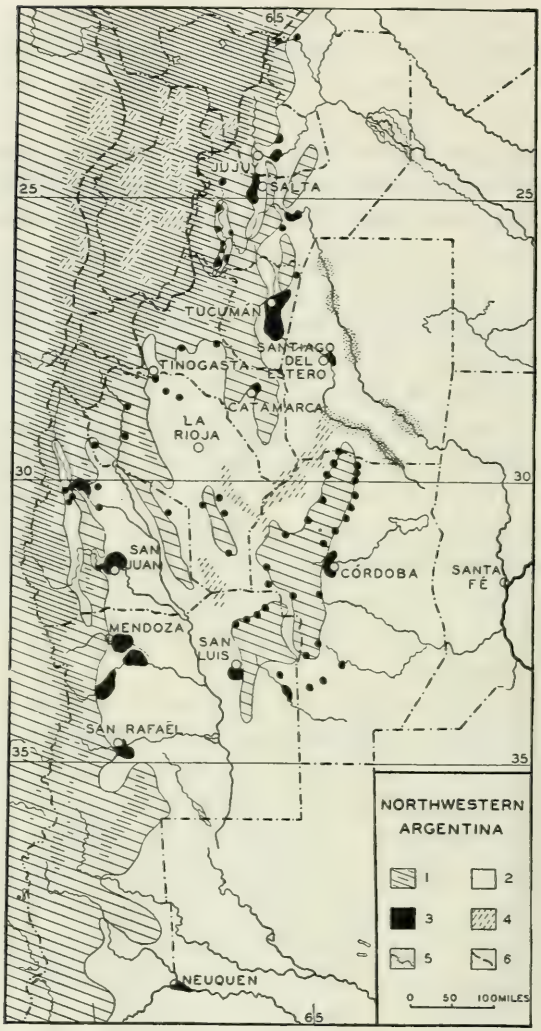

FIG. 145

The Irrigated Oases of Western Argentina represent mere specks in a vast area of arid plains and mountains; (1) mountainous areas, the close ruled are mountains above 10,000 feet elevation, (2) plains of northwest Argentina, (3) the oases, (4) salt plains or *salars*, (5) *bañados*, (6) the east and west borders of Puna de Atacama. (*After Denis, Kühn, Bowman and others.*)

est heights of the continent, in the gigantic mass of Mount Aconcagua in northern Mendoza. Plains, Pampean Sierra, Pre-Cordillera, the Andean Cordillera, and the extensive plateau, or Puna de Atacama, make up the complex of the Arid Plains and Mountains of Western Argentina (Fig. 145). In the northeast and the southeast broad plains dominate; in the middle the *monte*-covered Sierra de Córdoba, averaging somewhat over 5,000 feet, separates the region in part from the Pampa. Westward, by way of numerous outliers of the Andes—the

Fig. 146. Uspallata Station on the Trans-Andine

Bare towering mountains comprise a large part of northwestern Argentina. In such areas as shown in this picture, a hardy goat could not pick a precarious living.

Sierras de los Paramillos, of Famatina, of Aconquija and others—the surface rises rapidly to the towering ranges and snow-crowned peaks of the Andes (Fig. 146).

Most of the northeast has a flat surface with numerous swamps and a paucity of streams. Only two streams cross it: (1) the Salado, which rises in the Andes in the province of Salta and empties into the Paraná near Santa Fé; (2) and the Dulce, which rises in Tucumán, waters the oasis of Tucumán, flows with dwindling volume to the southeast for nearly 400 miles, and finally disappears in the great salt plain bordering Mar Chiquita. The Rio Salado of the west rises in the province of La Rioja, descends to the southeast and after being

joined by western tributaries which irrigate the San Juan, Mendoza, and San Rafael oases sinks into a great marsh in northern La Pampa.

For the larger part of the region there exists no drainage to the sea. This is the major zone of interior drainage for Argentina. Great salt plains abound in the west central portion, while the Puna de Atacama contains vast *Salinas*, or salt plains. One of the latter is known as *La Salina del Hombre Muerto*—Dead Man *Salina*—a name highly indicative of life conditions in the bleak Puna, all of which lies more than 10,000 feet above sea level.

Over the confusion of plain, plateau, and mountain, however, aridity prevails almost everywhere. Easily a third of the region receives less than 10 inches of rain per year; San Juan records slightly more than 2 inches. Eastward precipitation increases to some 30 inches in the northeast, practically all of which, as for the region as a whole, comes in the warm season; but high temperatures and rate of evaporation and porous soils rob agriculture of much possible advantage arising from the favoring distribution of rains. In winter, nearly the entire region receives less than 2 inches of rain, a feature greatly restricting pastoral industries. In general, only where irrigation facilities and, to a lesser extent, periodically moist depressions afford suitable land is cultivation of crops feasible. Within the region, one conspicuous exception exists, where the high Sierra de Aconquija causes a precipitation heavy enough over a small area to produce numerous crops without artificial irrigation; here lies the Tucumán oasis. In contrast to the luxuriance about Tucumán, one hundred miles to the northwest lies the most unattractive section of Argentina—the Puna de Atacama—where aridity, cold, and powerful winds with an enervating persistency combine to destroy all possibility of significant peopling.

Vegetation everywhere, outside of the well-watered intermediate slopes of Tucumán, Salta, and Jujuy, reflects arid conditions. Most of the area supports the *monte* formation, a scrubby growth occupying many different kinds of soils. In the east it is quite dense but towards the west and south it becomes brush-like and grades off into a zone of transition stands of xerophytic shrubs. The major aspect includes trees characterized by stunted growth, scraggly branching, light crowns, and a wealth of thorn growths which nevertheless are the basis of an important firewood industry in this fuel-starved land.

The more important species comprise the *caldén* (*Prosopis algarrobilla*), the *algarroba* (*Prosopis campestris*) and the *chañar* (*Gourliea decorticans*). In the drier portions small, spiny, low-growing, drab-colored shrubs dominate (Fig. 147). Cacti frequently grow in mats several acres in extent. Of the shrubs to the west, the *jarilla* (*Larrea cureata*) is most characteristic. At higher elevations in the Andean districts the transition *monte*, of which *jarilla* is a principal component, gradually gives way to a growth of sage-brush and eventually alpine

FIG. 147. CREOSOTE BUSH WEST OF MENDOZA

Typical desert shrub that covers vast expanses in arid western Argentina. Near the oases these pastures during the rainy season become significant pasture lands but most of the year only goats find sufficient forage. (*Courtesy of Charles Gooze.*)

grasses, which in the southwest support a growing pastoral industry. On the Puna, a few scattered hard grasses and more commonly several low resinous shrubs constitute the plant kingdom.

OCCUPATIONS

For the area as a whole the grazing of goats, low-grade cattle and wool sheep claims the major attention of the population not directly dependent upon the oases.

In striking contrast to the enormous mineral production of the lands to west and north, the Arid Plains and Mountains Region has developed an insignificant mining industry. The principal enterprise working metallic deposits lies in the mineral district of Famatina, in the province of La Rioja, where a mine worked with great difficulty at more than 14,000 feet elevation supplies most of the copper

produced by Argentina. Other districts principally in La Rioja, Catamarca, Córdoba, and San Luis yield small quantities of lead, tin, tungsten, and wolfram, as well as unimportant supplies of copper and precious metals. In addition to the metals, the region works deposits of salt, borax, and gypsum and exports a number of quarries. Indications of petroleum exist in many parts, notably in western Mendoza, but important production is a matter of the distant future. Major obstacles to great development of mineral industries comprise: the seemingly poverty of resources; difficulties of working deposits owing

FIG. 148. GOAT HERDERS' HUTS, SANTIAGO DEL ESTERO

Typical *monte* country where goat herding constitutes almost the sole occupation except the cutting of wood for the treeless Pampa and for the railways of northern Argentina. The flat poorly thatched roof indicates the small amount of precipitation that falls.

to the nature of the rock strata; lack of water; lack of transportation facilities and the distance to the sea; the chief interests of the country in the agricultural lands of the east.

Agricultural Industries.—Denoting aridity almost as plainly as does vegetation, the goat browses the meagre growths in all parts of the region (Fig. 148). Of domestic grazing animals, it thrives best on the sparse vegetation and the rugged relief of much of the land. Especially in the zone about the Sierra de Córdoba, the region has more than three-fourths of the goats in Argentina. Tended in general in groups of a dozen to seventy-five, the animal affords a valuable source of food and income for the Italian or Spanish farmer (Fig. 149). Goat-skins contribute an important item to the list of Argentine exports.

Lack of ready pasture restricts the possible number of cattle. Those raised prove fit only for *tasajo*, low-grade frozen meat, or draft purposes. As for sheep, the hot scrubby pastures of the north have little value, but in the cooler areas of the south conditions improve. In contrast to the mutton sheep of the Pampa, the animals of the Arid Plains and Mountains consist almost entirely of the merino

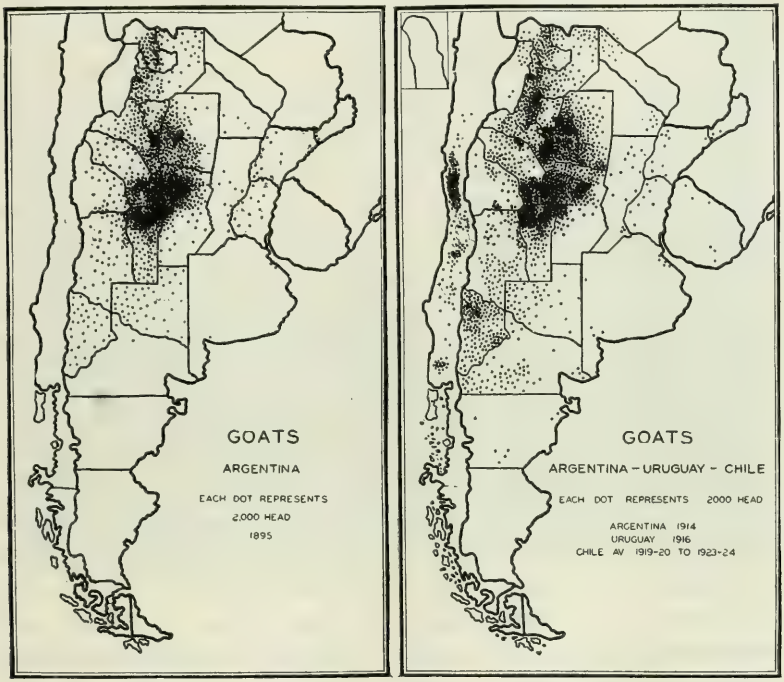

FIG. 149. DISTRIBUTION OF GOATS IN ARGENTINA, URUGUAY, AND CHILE

Nearly all the goats of Argentina graze in the *monte* and desert shrub country of arid Western Argentina.

type, for only the small weight and high value of wool make possible the grazing of sheep so far from the seaboard. Mules and asses also characterize the region, for the hardy animals are better adapted to the physical conditions than the horse. An important traffic of long standing has grown up on the export of mules on foot to the highlands of Bolivia. For many years, the main road between Buenos Aires and Bolivia followed the mule-trail used in conducting the animals on their difficult journey to the plateaus. In addition to the goats, cattle, sheep, mules and asses, the region has a livestock industry unique

in Argentina—that of the llama—carried on almost exclusively in the Puna de Atacama.

Variations in precipitation and temperature from season to season and from year to year cause extensive migrations of flocks and shepherds in quest of pasture; vast areas of salt plains afford neither fresh water nor forage. In the spring of the year flocks move from the irrigated alfalfa and other fields in the valleys up the ravines and mountain slopes, under the care of men, women, or even children, to graze on grasses, mosses or resinous shrubs. In some places where water is available, some member of the family moves with the flocks to the mountain zone for a season. Customarily boys, girls, and old women remain in the valleys to care for the fields and restricted crops and to guard the fixed property of the family. In other areas lacking water, the shepherds move into the high pastures for three or four days, returning to the rivers, springs, or wells at lower elevations for water and thence again into the mountains for a like period. Some families have two huts, one in the valley and the other in the high range country. The approaching winter cold at high elevations turns the shepherd and his flock towards the warmer, irrigated, valley lands. In contrast to the shepherds of the Cordillera farther north, who spend the whole year at high elevations because they can endure a few weeks of cold weather, the shepherds in this region move out for the season, as it would be impossible for them to remain during winter at the high summer camp. When they come down, they must move to the oases, for no other place will support them; also they must come with rights to valley land and water, else the migratory system would not be possible. Even in these settlements, scant forage forces the animals to graze on shrubs and dry desert grasses.

Practically the only crop production in the Arid Plains and Mountains of Western Argentina, apart from that in the large irrigated oases and the numerous ribbon-like stretches in the valleys of the mountains, is that in the *bañados* along the Rio Salado of the north and Rio Dulce. The *bañados* consist of cultivated plots to which the waters of flooded streams are directed by small diversion ridges. In the aggregate they make up a considerable acreage irregularly distributed. Thorn hedges protect the tilled strips, or *cercos*, from roaming stock and scorching desert winds. Corn is the chief crop; wheat also does well. Following the harvest of crops, animals graze on the fields.

REGIONAL POTENTIALITY

The burden of aridity and the large proportion of rugged terrain long will retard the expansion of this rather considerable area of Argentina. The republic has far to advance before consideration of a widespread utilization of the western plains and mountains becomes a

FIG. 150. THE TRANS-ANDINE RAILWAY

Much of Western Argentina will continue a region of sparse population—a land to be crossed with dread, discomfort, and rapidity; a long snow shed to protect the tracks from the great falls and slides of snow.

vital need (Fig. 150). Changes likely to occur in the region can comprise little more than those now in process. Minerals will undergo negligible exploitation for some time. In the southeast, with the aid of dry-farming methods the wheat-fields of the wheat crescent may claim parts of this territory. For the region as a whole, the dominant centers of activity in the land will continue to be the artificially-watered lands, garden spots which slowly but inevitably will take in a little more of the adjoining desert area and to which animals and men will migrate with actuating regularity.

CHAPTER XXV

OASES OF WESTERN ARGENTINA

In a manner strikingly emphasizing the barren character of the surrounding Arid Plains and Mountains of Western Argentina, the group of oases of the interior from the Bolivian frontier to Patagonia has played a vital rôle in the rise of Argentina. The great value of the irrigated lands has lain in their strategic significance as well as in their productivity. Located in the main on the extensive alluvial deposits composing the piedmont of the Andes and associated mountain masses, the oases have served as havens of food and rest for armies and for traders. To the west lie the arid, rugged bulks of the Andes; to the east stretch the waterless deserts, but at the points where the debouchment of Andean streams upon the plains has resulted in the building of alluvial cones and fans, the practicability of guiding water to fertile soils has led to the creation of rich agricultural districts. So great did the value of their sites prove, that two of these areas early rose to notable prominence among the provinces of Argentina—Mendoza and Tucumán. Though the meteoric expansion of the Pampa has lessened the relative importance of the oases, their continuous growth in production of important commodities and their historical significance have made each a leading element of the Argentine Republic.

Latitudinal differences and the availability of water have divided the zone of oases into three parts. In the north, where relatively abundant rains in addition to irrigating waters are available, oasis economy depends chiefly upon sugar cane. This section includes the sugar-producing oases of Jujuy, Salta, and Tucumán. In the provinces of Catamarca, La Rioja, and Córdoba, as well as in Salta and Jujuy, numerous small irrigated patches have arisen producing diverse products for a near-by population or for transient herders and traders; these compose an intermediate type of oases. The third portion of the irrigated zone—one of little rain and intense sunshine—depends chiefly upon the grapevine and temperate crops. In this

category fall the closely related lands of San Juan, Mendoza, and San Rafael and the more remote Rio Negro oasis (Fig. 151). In each case a clear uniformity may be pointed out in that the chief product is one of sufficient value or of sufficient difficulty in production as to overcome the handicap of distance from principal consuming centers;

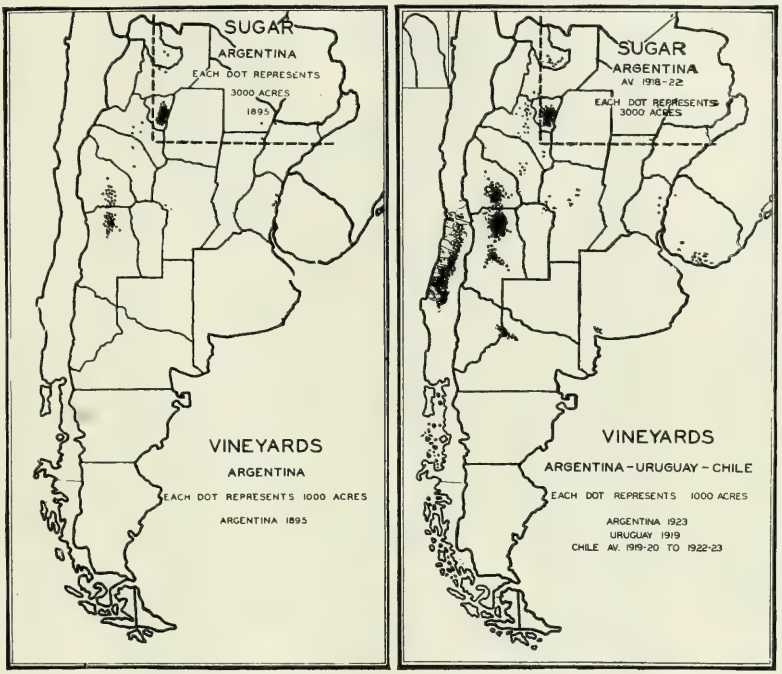

FIG. 151. SUGAR AND VINEYARDS OF THE OASES OF WESTERN ARGENTINA

Mendoza lies more than 600 miles from Buenos Aires, Tucumán at almost 750 miles.

TUCUMÁN OASIS

The province of Tucumán enjoys great prestige as the "garden of Argentina." Smallest among the provinces of the country, it has the greatest density of population per square mile and has had a dense peopling for centuries. Above all, this patch of luxuriance owes its prominence to its doubly-emphasized character as an oasis. Not only have the waters of its streams permitted the spread of artificial watering of the soil, but in its natural state the land is a veritable oasis set between the plains of the Chaco and the Arid Mountains of the west.

Owing to the propititating influence of the mountain backbone of the province—the Sierra de Aconquija—in causing the ascent of moist easterly winds and the consequent precipitation of moisture, the slopes adjoining the cultivated alluvial lands at elevations between

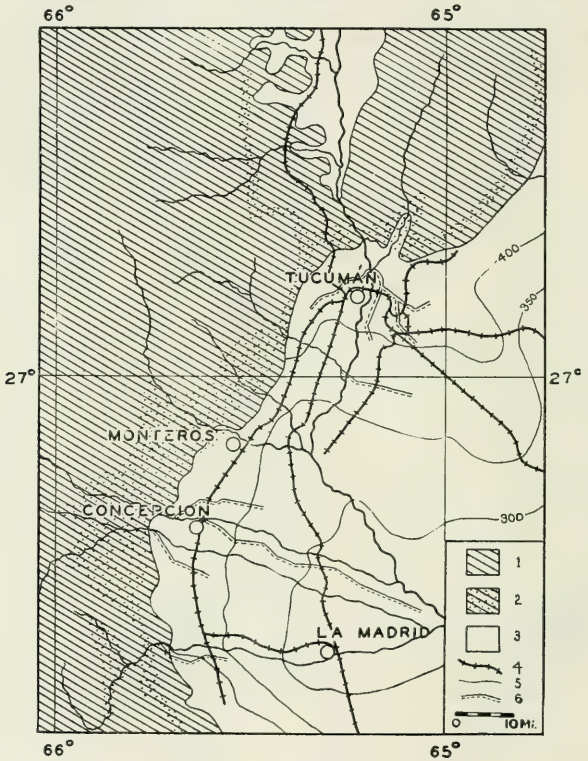

Fig. 152. The Tucumán Oasis

West of Tucumán the high forested mountain slopes receive heavy precipitation. From the foothills of the mountains the broad, gently sloping, piedmont plains, crossed by many streams and irrigation canals, afford an easy distribution of water to the sugar plantations. (1) Mountainous areas, (2) forested slopes, (3) piedmont alluvial plains, (4) railways, (5) contours, (6) the chief irrigation canals. (*After Bonarelli, Pastore, and Kühn.*)

1,300 and 5,000 feet hold one of the most exuberant developments of plant life on the continent. Here a riot of lianas and epiphytes enhances the aspect of lush growth afforded by the evergreen trees. In this zone, irrigation may be dispensed with; eastward the forest becomes increasingly sparser and irrigation becomes more necessary

with distance from the mountains; the relatively porous soils of the alluvial fan deposits support a forest of deciduous trees (Fig. 152).

Other climatic elements also accentuate the fortunate layout of these lands. Uniformly high temperatures and a great deal of sunshine contribute. High humidity and mists over the area render the danger from frost less common; abandoned plantations 35 miles from the Sierra indicate the eastern margin of the frost-free zone. But at the same time, the oasis has certain handicaps; cane must ripen in less than one year—early frosts occasionally force the grinding of cane before it reaches maturity; in some seasons rain far below the annual average of 38 inches seriously damages the cane crop.

Numerous streams descend the eastern flank of the Sierra, spread out over the great, piedmont, alluvial plain, consisting of fine silt loam soils of high potash content overlying sand and gravel, and later join the Rio Sali and the Rio Dulce near the outer margin of the oasis. In small usable units, these streams provide irrigation water without the construction of great dams. A favorable site near the passable all-year crossing of the Sali has become the site of modern Tucumán.

With subtropical climate, abundant waters, and fertile soils, the region is one producing a variety of crops. In addition to sugar, which occupies half the cultivated area of 350,000 acres, and corn which grows on one-fourth of the land, the major crops are alfalfa and rice. Fruits and tobacco also furnish a large income to the oasis; pineapples prove especially profitable.

Cane came to be of early importance in Tucumán. In the middle of the eighteenth century, a group of Jesuit priests set up the first grinding mill in Argentina, but because of political adversities the industry lapsed. In its stead, the advantages of the location on the high road to Peru led to the rise of tanning, harness-making, and the manufacture of wagons. Wheat and tobacco, for provisioning travellers, also held an important place. Gradually, however, the growing needs of the country and the accumulation of capital in Tucumán led to revived interest in sugar. With the completion of a railway from Córdoba to Tucumán in 1874, the region began its rapid rise. Production trebled between 1876 and 1880. Today, with a production of almost 400,000 tons of sugar, Tucumán accounts for some 80 per cent of the sugar output of Argentina.

In general, large refineries work most of the cane, with paid workers

or contract renters. In addition, independent cultivators sell their crops to the factories. As much as one-half of the cane harvest moves by rail to the sugar centrals. Though the agricultural population is considerable, during the harvest season of May and June, a large labor supply must be recruited from adjacent regions.

While conditions on the whole favor a sugar industry in Tucumán, various shortcomings exist. Owing chiefly to climatic conditions and to diseases, the cane has a low sugar content. Disease-resistant

FIG. 153. TUCUMÁN SUGAR

Much of the piedmont plain of Tucumán grows sugar cane; note the small homes of the laborers in the foreground.

varieties from Java have replaced old variegated and purple types. Moreover, because of frosts, droughts, or the diseases, the production of sugar varies greatly from year to year, causing a frequent adjustment of tariff schedules on sugar. In years of large output high tariffs are necessary to maintain profitable prices, but in years of low production imports become necessary to satisfy home demand (Fig. 153).

THE OASES OF JUJUY AND SALTA

A new sugar-producing center of the northwest has grown up some 200 miles to the north of Tucumán, where in a crescent-shaped area along the Rio Jujuy deep, rich, alluvial soils, much sunshine, and high temperatures favor the cultivation of cane. Irrigation here is more a necessity than in Tucumán, but frosts seldom occur. Moreover,

sugar content and yield exceed those of Tucumán. As in other areas, the Jujuy oasis produces a variety of things. All are subsistence products except sugar and animals.

Each estate consists of a large clearing in the forest. Most of the labor comes from neighboring lands. Chaco Indians supply the major source of harvest labor. Each year some 6,000 reach the oasis and occasionally whole tribes migrate. At present the region produces some 70,000 tons of sugar per year and ranks second to Tucumán. While Jujuy may have certain advantages, a small labor supply, little capital, long distance of transport for all supplies, and the small size of available alluvial areas retard development.

A third sugar district of Argentina has developed on an extensive piedmont in the intermontane basin of Salta, where conditions of agricultural advance parallel those for Jujuy. The annual output of sugar totals 25,000 tons. The Salta district also has special distinction as an intermediary center of the present cattle trade between Argentina and northern Chile and of the earlier large movement in cattle and mules to the mines of Bolivia and Peru. Restricted in arable land, remote, and with sparse population, these oases suffer in competition with Tucumán in the sugar trade but they are vital spots in the cattle and mule traffic to distant mountain and desert markets.

OASES OF CATAMARCA, LA RIOJA, AND CÓRDOBA

Differing considerably from the sugar-producing oases of the far north and the vineyard areas of the south, a number of minor irrigated spots lie in the provinces of Catamarca and La Rioja and in the less-favored portions of Salta and Jujuy. These lands have evolved a distinct economy, owing on one hand to their greater aridity and paucity of streams and to their remoteness from the principal trade routes of the interior of Argentina. In general, the irrigated districts are small and produce chiefly wine and alfalfa as money products. Their markets lie in the near-by mines or in the herds of cattle being driven over the mountains to Chile. Yet each produces a variety of subsistence commodities such as vegetables and fruits. Likewise each has its quota of goats and other animals as the isolated patches must be well-nigh sufficient unto themselves.

As a rule these tiny oases lie on the alluvial cones of streams flowing into one of the numerous structural valleys of the region. Agri-

culture exists only under severe burdens. Scorching winds, the *zondas*, resembling the foehn, may dry up the water of springs and of the irrigation trenches. Moreover, the soils are coarse and permeable alluvial deposits, which absorb rainfall immediately. Resinous shrubs and cacti afford practically the only natural vegetation. Havens for man and beast, they are mere specks in a vast semi-arid region around which revolves the life of bordering lands.

A considerable distance to the east of the other oases lies the oasis of Córdoba on the eastern flank of the Sierra de Córdoba and on the outer margin of the Pampa. Here the only great irrigation project in Argentina collects the waters of the upper Rio Primero and transforms desert wastes into pleasant orchards, gardens, and meadows of grapes, other fruits, vegetables, and alfalfa. The adjacent *monte* harbors many goats and considerable numbers of cattle, which find sustenance in oases patches during protracted droughts. More accessible to centers in the Pampa than any other oases, Córdoba cares for large numbers of tourists during the summer months; an overnight ride from Buenos Aires places one in the pleasant environment of Córdoba, while it takes 24 hours to span the distance from Buenos Aires to Mendoza. Local springs and beautiful little resort towns in the Sierra de Córdoba, connected by fair highways, add to its variety of foods in attracting people from the level lands and urban centers of the east.

OASES OF SAN JUAN—MENDOZA—SAN RAFAEL

In contrast to the lands of Tucumán, the great oases of the south represent entirely artificial developments in the midst of an intensely desert environment (Fig. 154). Here there exist no rich forests. Instead, on the plains bordering the present alluvial cones and fans, prevails a growth of the xerophytic *monte* forms while the alluvial deposits support a meagre stand of *jarilla* (creosote-bush) and cacti. As in the north, however, a strategic location on a main route of travel led to early settlement, in this case even long before the arrival of the Spanish *conquistador*. But in these southern lands the system of agriculture developed different lines, owing to the greater aridity, so that the major product has come to be wine, a commodity eminently suited to bear the transportation costs to the eastern consuming centers. Just as the relations of the north to markets for livestock

from the plain has made alfalfa an important crop, here similar conditions with reference to Middle Chile long contributed to the dominance of the productive forage plant as the principal crop of the region. The decline in the cattle traffic and the rise in significance of the wine have caused a lessening in rank of alfalfa, but in certain portions it still preponderates, in order to supply feed for beef cattle required in the region and for the large number of draft animals and to furnish

FIG. 154. MENDOZA VALLEY NEAR LUJÁN

A valley of vineyards, fruit orchards, and alfalfa pastures; beyond lies the arid foothills and farther on the high Cordilleras; note the sheep and goats grazing in the middle pasture and the flat-roofed huts.

seed for establishing alfalfa range on the cattle lands of the east.

So profitable has the régime of viticulture proved that the region, particularly at its chief center—Mendoza City—has become one of the most wealthy portions of Argentina and dominates the economic life of the largest group of irrigated lands in the country. Unlike Tucumán, which attracts relatively few immigrants, Mendoza has drawn about itself the largest group of European-born population in the interior of the continent. In the vineyards the Spanish or Italian farmer finds a system of agriculture with which he is thoroughly acquainted, and once his vines have come into full bearing he has a rich source of income for a number of years.

The aridity of the region and the precipitation, chiefly snowfall on the high mountain masses to the west, from which issue the life-giving waters, constitute the principal bases of the oasis agriculture. The intense aridity has great value in its prevention of cryptogamic diseases. An additional noteworthy advantage of the climate is a rather severe winter which further favors control of diseases and insect pests affecting crops. Moreover, a long hot summer affords an almost ideal growing season for the vine. On the other hand, late frosts in spring and hot winds in summer (the *zonda*) may wreak

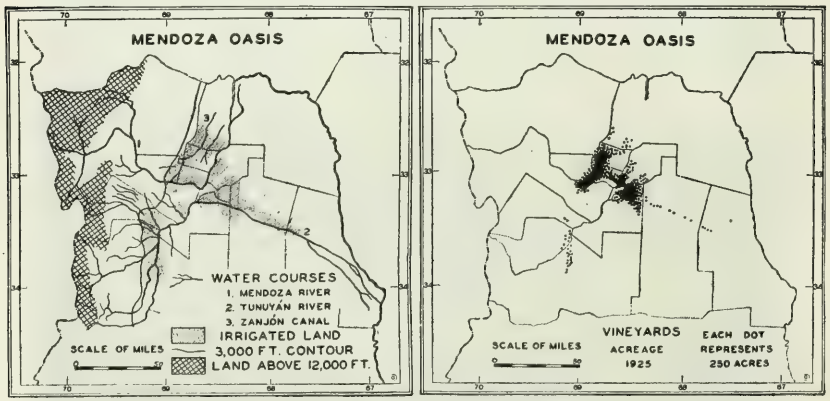

FIG. 155. THE MENDOZA OASIS

What are the physical features that make this a garden spot of Argentina? (*Compiled from four maps by Dr. Charles Gooze.*)

havoc; also, hail frequently causes great damage over small areas at the mouths of the valleys. Yet, on the whole, conditions are excellent for viticulture.

Since few gaps occur in the lower slopes of the mountain ranges, water becomes available at only a few points. The San Juan oasis derives its waters from the San Juan River. About Mendoza City, the chance approach of the Tunuyán and Mendoza Rivers has enabled the growth of the great oasis of northern Mendoza. At the south, a similar proximity of the Diamante and Atuel Rivers serves to guarantee irrigating waters for a new, rapid-growing, extensive area, the San Rafael district. Although the coincidence of growing season and period of melting snows is of supreme importance to the oasis, floods resulting from a too rapid melting of snows in some years reach grave proportions.

The agricultural lands occupy the extensive alluvial fans of the several rivers (Fig. 155). The comparatively gentle slopes facilitate the easy distribution of water to large areas of deep, fertile, sandy, loam soils. Inasmuch as irrigating water generally proves plentiful, the porosity of the soils especially favors the deep-rooted grapevine and alfalfa. In addition the sandy and gravelly character of most of the deposits contributes to the favoring rapidity with which the soils heat. Content of lime, phosphoric acid, and potash averages high,

FIG. 156. VIÑEDOS DE ARIZU

In one property stretch 6,000 acres of vineyards; to the left of the center note the cloud of dust made by the line of wagons.

but nitrogen and humus are low. Each application of silt-laden water adds new materials to the present deep accumulations.

The Vine.—To Argentina, essentially a Latin country, wine is an almost indispensable article of the daily diet. Such being the case, consumption of wine from year to year shows no great fluctuations, provided prices remain normal. Hence the vine serves as possibly the most logical crop as the basis of oasis economy in middle western Argentina (Fig. 156).

From earliest days of European settlement, the grape has held a fairly significant place among the cultivated crops. Small quantities of wine reached Buenos Aires in the sixteenth century. Development was slow, owing chiefly to the difficulties of transportation across the Indian-infested desert and Pampa. Moreover, the profits gained by

fattening cattle from the Pampa on the alfalfa fields of the oases prior to their trip across the mountains to Chile, hampered the extension in vine acreage. San Juan, not so well placed for the cattle-trade, gained leadership in the vine for some time, though on a small scale. As for San Rafael, its development dates only from 1880, when the removal of the Indian menace permitted its growth as an agricultural district. In the late years of the nineteenth century, a fundamental change took place in the Oases of San Juan, Mendoza, and San Rafael, for by the completion of rail communication to Buenos Aires in 1885, the prime geographic handicap of the land—distance to market—lost much of its influence. Since that date, the growth in vine acreage has been uninterrupted notably in the irrigated lands of northern Mendoza, where the advantages of greater early importance, irrigating facilities, and focal situation gave the land a start towards predominance as the vineyard oasis of Argentina. Today (1928) Mendoza has 170,000 acres of grapes, San Juan 100,000, and San Rafael 35,000, in the aggregate 82 per cent of the acreage in grapes in Argentina.

The *criolla* vine, originally from the Canary Islands via Peru, gave the region its early importance. Almost completely gone from Mendoza, it still survives in the somewhat less-advanced San Juan oasis. Its yields were high, but the sugary rough grapes made poor wine. Practically all of the newer vineyards consist of French varieties of excellent quality. The vines are trained on wire and pruned low, which is inexpensive and facilitates cultivation, ripening, and harvesting.

Although much of the land is owned in large estates on which the immigrant, colonist, or native laborer tends a portion of the vineyard or works on contract labor at a specified price, numerous small properties exist. Producers consist of two types—the *viñatero*, one who grows the grapes only, and the *bodeguero*, one who grows grapes and makes wine, or one who only makes wine. The *viñatero*, who must sell to the wine manufacturer, has to deal at the latter's terms. The *bodeguero* sets the time for harvesting the grapes, the price to be paid, and the date of delivery.

Although in season the consumption of fresh grapes is large, the bulk of the crop goes for the manufacture of wine. The use of table grapes increases, especially for the export trade. The Mendoza oasis has 17,000 acres producing quality table grapes.

In supplying the markets of the country as a whole, 2,460 plants

produce almost 150,000,000 gallons of wine; per capita consumption approximates 14 gallons per year. Of the total manufacture, the San Juan-Mendoza-San Rafael plants produce 96 per cent. The wineries attain huge proportions; one has an annual capacity of more than 6,000,000 gallons of wine. While these wineries, or *bodegas*, make both high- and low-grade wines, the bulk of the output consists of a strong red wine of low grade.

An annual capacity of 6,000,000 gallons of wine for one *bodega*, or winery, indicates considerable skill in developing a well-integrated

Fig. 157. Bodega Giol, Mendoza

industry, at the same time that it denotes a high investment of capital. With the economies possible by an organization such as this, the producers achieve almost complete independence with respect to supplies needed for the manufacture of wine. In this case, the establishment, aside from its machinery and basic equipment such as storage and fermentation vats, provides for all of its own needs except barrels, bottles, and part of the power requirements. Carts made in the *bodega* shops and drawn by mules raised on the alfalfa holdings carry the vintage of vast vineyards to the plant. Beautiful plantations of poplar, in addition to serving as windbreaks, furnish wood for boxes to hold the bottles which come from a near-by factory. After all the juice has been pressed from the grapes and alcohol and other by-products obtained from the *bagasses*, the *bodega* secures practically

all of the fuel necessary to operate the main power plant by burning the dried residue. Thus, a *bodega* represents a great industrial establishment with manifold ramifications (Fig. 157).

Other Products of the Oases.—Although the vine dominates the economic life of the land, other crops are of importance. This situation becomes more evident in recent years owing to difficulties in the wine industry resulting from over-production. In actual acreage, alfalfa occupies more land than grapes. Well adapted to deep soil,

Fig. 158. The Main Canal, Rio Negro Oasis

A new irrigation project attracting settlers from various parts of Argentina. (*Courtesy of the Buenos Aires Great Southern Railway.*)

much sunshine, and irrigation, it is of special value as a forage for the numerous work cattle of the region and for fattening animals before the long trek across the Andes to Chile. Corn ranks third in area. In addition, potatoes and fruits grow on considerable land at present and promise much for the future.

Owing to their distance from the sea, the urban centers, chiefly Mendoza City (population 80,000), have developed a number of small-scale industries, such as flour milling, manufactures of building materials, wagon-making, and the like. The poverty of local fuels restricts great development, although the future hydro-electric power enterprises will alter the case. Nevertheless, imports of commodities from the east are considerable, a feature well reflected in the high prices current in the oasis.

THE RIO NEGRO OASIS

Near the confluence of Rio Limay and Rio Neuquén stretches for 60 miles a narrow but promising oasis in the making (Fig. 158). It has a fine clay-loam soil, short hot summers, mild winters, much sunshine, but lies far from Buenos Aires. Grapes are most important, but apples, peaches, wheat, barley, and vegetables do well. Alfalfa for transient stock ranges occupies much of the land. In contrast to the great oases to the north, land is parcelled out by the national government in squares of 250 acres, under a ruling that within two

FIG. 159. THRESHING ALFALFA, RIO NEGRO OASIS

The Oases of Rio Negro, San Rafael, and Mendoza supply all the alfalfa seed for planting the enormous acreage of valuable alfalfa range on the Pampa. (*Courtesy of the Buenos Aires Great Southern Railway.*)

years the land must be fenced, a poplar windbreak planted, and a house built. Limited by water supply, available land, and isolation, it will remain only a garden strip in a vast grazing region (Fig. 159).

THE FUTURE

Long of considerable importance in Argentina, the oases of the west promise to maintain their status. Not only do they afford vital zones of production amidst the desert plains and mountains of the west, but they also produce commodities of great value to the country as a whole. Three major handicaps, however, limit the development of these lands—(1) the relative paucity of arable land, (2) a restricted water supply, and (3) the distance from market which

restricts production to certain crops and commodities. An expansion of cultivation is certain with the improvement of systems of irrigation, with the conservation of waters now being used for many trees along the ditches and for watering dusty roads twice daily, especially in Mendoza during the season of peak traffic, and with the reclamation of lands rendered alkaline by improper watering; but these oases have no great hinterland to cause the rise of influential entrepôts. Inevitably the cities of the seaboard, nearer the vast plains of the Pampa, nearer centers of population, and burdened less by the problem of transportation, will advance far more than Tucumán and Mendoza, which already are beautiful modern cities with paved streets, electric lights, and tall graceful trees lining the avenues. Nevertheless, the gardens of the interior will always retain the prestige and color characteristic of oases over all the world.

CHAPTER XXVI

ARGENTINE PATAGONIA

From its northern boundary zone, a few miles north of the Rio Negro drainage system, to its far southern extremities in Tierra del Fuego, Argentine Patagonia embraces more than 300,000 square miles. Much the larger part of this vast territory has significance only in that it affords a useful illustration of the degree to which a land may prohibit human settlement (Fig. 160). Many years will

FIG. 160. USHUAIA, TIERRA DEL FUEGO

A settlement in the far south where few people can subsist; here the timber line and the snow line almost meet sea level. (*Photo by Rollo H. Beck; courtesy of the American Museum of Natural History.*)

pass before the region reaches a density of population of one person per square mile; at present the figure is scarcely four-tenths of a person per square mile. Nevertheless, certain portions have notable importance for Argentina. The more favorable steppe lands of southern Patagonia are the ultimate refuge for the sheep which population forces out of the Pampa. Forest resources on the Andean slopes, though comparatively limited, may in time mean much to the treeless tracts of the Pampa. At Comodoro Rivadavia in southeastern Chubut, Argentina has its only important exploitation of petroleum, again a feature of particular value to the fuel-less, as well as treeless, Pampa.

Isolation affects profoundly any economic life in the area. Ushuaia, on the south coast of Tierra del Fuego, lies 1,500 miles from Buenos Aires. Few navigable rivers lead far into the interior. Hence, the far more attractive Pampa paid little attention to Patagonia. Until the campaign of 1879–1883, intended to open the land to colonization, the aboriginal Indians closed a large area to possible white occupation. Gradually settlement took place. In the northwest, the tiny irrigated spots of Neuquén attracted a first stream of settlers. Here the cattle trade with Chile proved so lucrative that for many years the economic interests of the territory leaned more to Chile than to Argentina. Along the Atlantic coast, other groups found means for establishing settlements, while from the Magallanes territory of Chile came the sheepherders to seek the pastures of southern Santa Cruz. The northwest has peopled similar irrigable lands to the south and east of the earliest colonies, and from the coast and the south the raising of sheep and to a slight degree the tillage of land have moved along the valleys and into the interior plateaus. Though Argentine Patagonia has the most rapidly advancing sheep industry of the country and an important center of irrigated crops in the Rio Negro oasis, isolation persists as the one great deterrent. Railroads now join various districts to the coast or directly to the Pampa, particularly in the north. But as those effects of remoteness dependent upon distance from centers of population lose power, the factors of relief, soil, climate, and vegetation tend to perpetuate the aspect of isolation in Argentine Patagonia.

PHYSICAL CHARACTER

The three major types of terrain composing Argentine Patagonia are lands differing far more in point of relief than in utilization. As a whole, the aspect is one of rugged territory, forest-clad in small part in the west, steppe chiefly in the south, and sage-brush, barren, windswept expanses in many sections though more notably in central Santa Cruz and Chubut.

Here the Cordillera of the Andes constitutes a far less formidable barrier to transverse movement than to the north, but at the same time there exists less reason for such traffic, so that the advantages of lower passes and alpine pastures lose much of their significance. Nevertheless, the comparative ease of negotiating the passes of the

northwest, in particular, has played an important part in the early peopling of many districts by Chilean Germans from the southern lands of Middle Chile. In the territory of Neuquén, where the Patagonian section of the Andes attains its widest extent, the mountains lie almost entirely below 10,000 feet. Southward for some distance the Cordillera both narrows and rises, though the abundance of breaches continues. The portions about the Strait of Magellan retain the interrupted character but are not nearly so high, though rising to more than 6,500 feet in Tierra del Fuego. In the stretch from Lake Nahuel-Huapí to the far south glaciation has exercised an important influence on the region by the formation of numerous lakes, the beds of many of which have made excellent farmland, and by distributing deposits on neighboring lands. In addition, the large number of existing glaciers and glacial lakes, which depend upon the two major ice-caps of the area, together with bodies of water now occupying former glacial troughs, make the "lake-country" of Patagonia an increasingly popular resort for tourists.

East of the Andes and south of the latitude of Lake Nahuel-Huapí lies the sub-Andean depression, continuous for only short distances owing to interruptions by conditions of rock structure and morainic deposits, but nevertheless the most attractive part of Patagonia. Distinctly lower on the whole than the Andes to the west or the plateau to the east, it affords relatively extensive plains, lake-strewn, but covered with nutritious grasses.

In parts rising to more than 2,000 feet above the sub-Andean zone, to a total elevation of 5,000 feet, the series of plateaus of Patagonia extend eastward to the narrow coastal plains. Far less picturesque and as a whole far less suited to agricultural development, it nevertheless has had the greatest growth in industries, largely in consequence of access to the sea. Deeply incised valleys cut the uneven surface of the plateaus from west to east, but tributary systems are small because of the paucity of waters on the vast tracts of rock debris on the sandstone and crystalline plateaus of the north and on the areas of recent lava in Santa Cruz and Chubut. In Chubut and Rio Negro territories, large areas have no drainage to the sea. Here and there, the strong winds have eroded large hollows, in which the deposition of æolian materials has occurred. The better drained of these, the *mallines*, bear fine growths of bushes and grasses. Others have de-

veloped highly saline soils. Though liable to destructive floods as a result of heavy rains in the Andes, several river valleys provide fertile soils which may be cultivated under irrigation. The Rio Negro system and that of the Rio Chubut have undergone greatest development.

Except for the lands of the far southern plains, the sub-Andean trough and the Cordillera, the region is semi-arid to desert. Factors giving South Chile its heavy rains cause the abundant watering of the Andes and the near-by lands in Argentine Patagonia. Western Neuquén receives more than 60 inches annually, southern Tierra del Fuego 55 inches. Much of the yearly total falls as snow, a feature which combined with low temperatures occasions a low snow-line, some 2,300 feet in Tierra del Fuego, and also causes a high mortality in the flocks of sheep. East of the strip of heavier rains, a marked contrast occurs because of the rain-shadow effect produced by the descending winds. All of central Patagonia receives less than 8 inches of precipitation per year. The rain falls only occasionally, and then in heavy showers; cold winters and cool short summers prevail. Southward, the lower and more interrupted Andes to the west and the tapering of the continent allow a free play of oceanic winds over the land, giving a cool moist and windy climate, with much less range of temperature than in the drier north. The plateau in southern Santa Cruz which supports a large number of the sheep of Patagonia receives between an annual precipitation of 10 to 20 inches, coming in prolonged drizzles accompanying cyclonic storms. In the south the winters are particularly cold and everywhere they prove disagreeable, while south of the Chubut River summer temperatures combined with many cloudy rainy days prevent the proper ripening of cereals. In many portions of the plateau, especially the northern, the powerful westerly winds further hamper industries. Though they operate the indispensable windmills, they also lift clouds of dust which at times stifle man and beast and which seriously damage the fleece of the flocks.

In accordance with the several differences in climate, vegetation displays a varied character for the region as a whole. In the northwest the rains of the Andes support a forest of pines (*Araucaria imbricata*). South of Lake Nahuel-Huapí, this gives way to a growth chiefly of Chilean beeches, up to an average elevation of 4,000 feet. The predominant trees are: *coihué* (*Nothofagus dombeyi*), an evergreen

beech; *lenga* (*N. pumilio*) at higher elevations; *ñirre* (*N. antarctica*) in swamps and on gravel beds and burned-over lands; *ciprés* (*Libocedrus chilensis*), and *canelo* (*Drimys winteri*), a valuable hard wood (Fig. 161). A dense underbrush in the *coihué* forests provides an

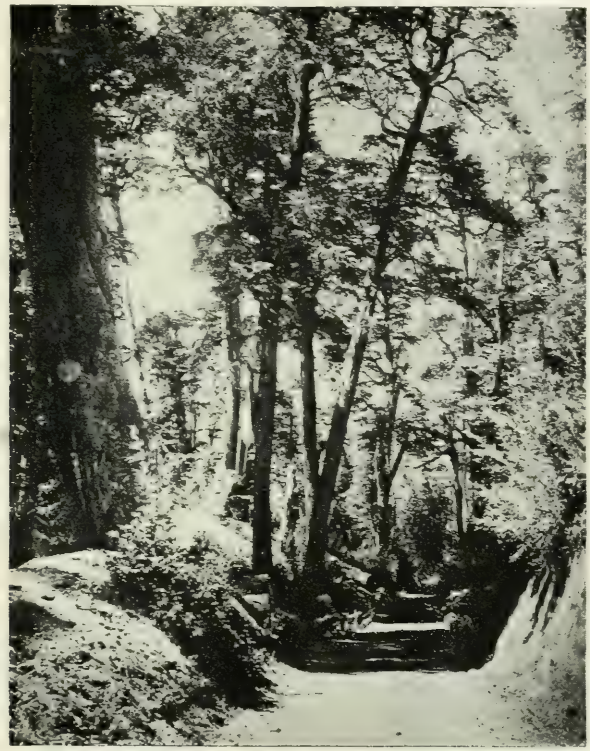

FIG. 161. THE ROAD TO LA CUMBRE, LAKE NAHUEL-HUAPÍ

Valuable timbers cover considerable areas on the eastern flank of the Andes in Patagonia. (*Courtesy of the Pan-American Union.*)

abundance of succulent growths for livestock. In the interior depression, chiefly bordering the tableland, the *ñirre* grades into the steppe which covers much of the south. At the margin of the forests extend grasslands, or *serranías*, which provide considerable grazing area for sheep and cattle. To the east, vegetation becomes progressively sparser and of less utility, much more so in the north than in the south. On the northern plateaus, the brush of the *monte* is widely dispersed, though in an even more xerophytic character. Disappear-

ing gradually towards the south, this formation is succeeded by a stand of alternating *Gramineae* and small bushes constituting the bush-steppe of Patagonia. The young sprouts in tufts of the bunch-grass known as *coirón*, a species of *Stipa*, provide the principal source of forage for grazing stock.

PATAGONIAN AGRICULTURE

Aridity and cold, in addition to the need for a product of high value per unit of bulk, contribute to the dominance of sheep grazing as the leading agricultural activity in the region. While the south has areas with sufficient rainfall to permit the growth of crops, the low temperatures of summer make ripening impossible. Moreover, the soils of the moister lands are too cold for cultivation; those of the sub-Andean zone comprise heavy glacial clays over large areas. Hence, significant production of crops becomes possible only in the less cool though more arid districts roughly in the area north of central Chubut.

Farming.—The cultivated lands are of three types. Though frequently hampered by spring as well as summer frosts, numerous valley bottoms, so-called *vegas*, in Neuquén have sufficiently favorable conditions for the growth of wheat, rye, and potatoes under irrigation. These small plots produce crops to support the local population and also furnish provisions for shepherds on the tableland. A second type of cultivation lies in the sub-Andean depression, where there is no need for irrigation. Here only the deepest basins, those which become warmest in the short summer, produce regular crops. The Valley of the 16th of October, at the headwaters of the Rio Chubut, is the most important of these. Settled by a group of Welsh farmers, who had come from eastern Chubut in the 1890's, the district now has some 70,000 acres available for cultivation. Wheat occupies most of the land because of the isolation of the territory. In addition, a variety of garden vegetables and fruits of temperate climates adds to the local food supply. The plateau area proper holds the third class of crop land, in three zones—the Rio Negro district, the valley of the Rio Chubut, and a small patch near Comodoro Rivadavia. The size and mode of development in the Rio Negro oasis places the area with those of the Arid Plains and Mountains of Western Argentina, Chap. XXIV. Restricted by amount of arable area, the lands at the mouth of the Rio Chubut produce excellent

crops, having shipped quantities of grain to Buenos Aires and now concentrating on the export of alfalfa. Here lives the Welsh colony that peoples the Valley of the 16th of October. The fields about Comodoro Rivadavia represent an effort to supply the oil districts with forage, principally for cattle, and with fresh vegetables, difficult to bring in from the outside.

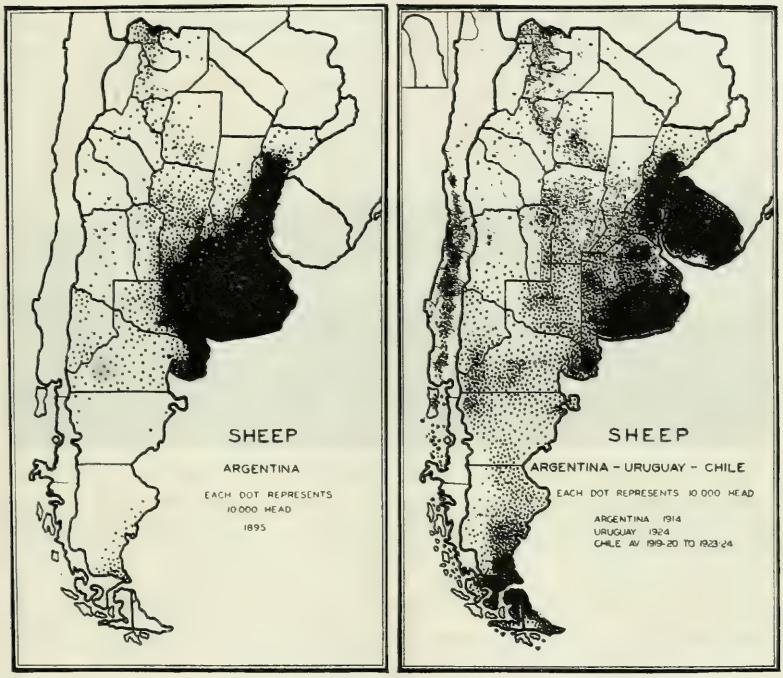

FIG. 162. DISTRIBUTION OF SHEEP IN ARGENTINA, URUGUAY, AND CHILE
While the Pampa has lost greatly in the number of sheep since 1895, Patagonia has gained large numbers; why did sheep stay out of Patagonia so long?

Sheep.—The Patagonian portion of Argentina has one-fourth of the sheep of the country and supplies one-half of its wool exports (Fig. 162). Over much of the vast expanse, owing to the dominance accorded the industry by climate, vegetation, and isolation, the sheep herder and his dog are the lords of the land. Few other animals find a place in the region. The arid slopes of Neuquén and western Rio Negro support a few hundred thousand goats; various centers of population and favorable pastures in the west foster cattle-raising;

a few horses are kept for riding purposes, but the region as a whole is a land of sheep.

Because of differences in climate and vegetation, great contrasts exist between the industry in the north and that in the south. In the former lands, the flocks composed largely of creole type, a descendant of the Spanish merino, find scant pasturage and a scarcity of water over much of the region. The carrying capacity of the ranges of northern Patagonia averages less than one-tenth that of the native grasses of the eastern Pampa, about one sheep to every 8 or 10 acres, necessitating a wide ranging of the animals. In some sections, trans-

Fig. 163. The Chief Product of Patagonia

A flock of good grade sheep in a small oasis in the Rio Negro valley feeding in preparation for the migration across the arid tablelands. (*Courtesy of the Buenos Aires Great Southern Railway.*)

humance is well developed; the sheep of the plateau move from the winter pastures, when the water supply gives out, to the lower slopes of the Cordillera for summer ranging; transhumance is practised only by *intrusos*, who go from public lands of the tableland to unowned land of the Cordillera. Government concessions to permanent ranchers, who do not desire the migrating flocks, and who put obstacles in the way of the *intrusos*, are reducing transhumance; gradually both winter and summer range are being controlled by permanent ranchers. Sheep grazed on these arid pastures yield only a medium quantity of fair-grade wool, which becomes foul with dust and burrs. The location of a permanent supply of fresh water is the chief concern of the herder; in some sections sheets of water have been tapped by wells, but none exist on the crystalline areas in the central portion or on the red sandstone districts farther west. On the western

margin, wells are sunk in the valleys along the track of an underground stream. Along the eastern coast, south of the Rio Negro, deep borings give every ranch its sheet-iron tank and a tall windmill.

The far more favorable south has experienced the most rapid growth in herds. Here the conditions characteristic of the great sheep industry of South Chile (Chap. IX) have given Santa Cruz half the sheep of Argentine Patagonia in much the smaller part of the region. Climate and the practicability of establishing freezing plants on the coast have led to the stocking of the south by Romney Marsh and Lincoln breeds. Puerto Gallegos, San Julian, and Puerto Deseado prepare large quantities of sheep for export as frozen mutton. From the coast the industry, by way of the several valleys, has gone far into the interior (Fig. 163).

Cattle.—In the sub-Andean zone of marginal forest and *serranía*, cattle-raising enjoys preference over that of sheep, though here neither industry has developed much importance. *Pobladores* carry on grazing on the public lands, and ranchers pursue the industry on tracts settled under concessions and fenced. The high alpine pastures, above the forest, are utilized as summer range from December to March; the forest serves throughout the year. Below 3,500 feet clumps of bamboo in the undergrowth provide shelter and fodder not covered by the heavy snows. Strong winds lessen the winter utility of the *serranías*, but tufted grasses in many open valleys near lakes or streams graze flourishing herds. In the summer, the *serranías*, where running water is available, serve to good advantage.

EXPLOITATION OF THE FORESTS

Though the forests cover considerable areas on the mountain slopes, they have induced little development. Forest exploitation is favored by large reserves of water power, which are little used within the region.[1] Large areas have been burned; the proportion of old unsound trees is estimated to range from 60 to 80 per cent in the heavy stands of *coihué* and *lenga*, and 50 per cent in the *ciprés* areas. Remoteness from shipping facilities has hindered operations; even with railroads, the Andean forests can attract little capital. Lumbering

[1] This great reserve of hydro-electric energy without a hook-up system cannot be transported under present conditions of transmission to Buenos Aires, more than 1,000 miles away; and that great arid belt, devoid of power resources, lies between the two.

in the mountains requires a large initial outlay, a great running expense, and costly transportation in the forest—the *coihué* sinks in water. In general no large pure stands of any one tree occur, and most of the wood fibers have little value. The *Araucaria* forest of Neuquén extends over a comparatively large area, and its pulp furnishes a good paper stock, but the zone in which it grows is particularly difficult of access.

MINERALS

Though the Cordillera of Patagonia may possess rich deposits of minerals, any development, should deposits be discovered, will be retarded by remoteness, meagre transport facilities, and sparse population. The territory of Neuquén has the chief coal resources of Argentina, unknown until recently. While some coal has been mined and shipped, little development may be expected for some time. The good coal seams yield medium- to high-grade bituminous, but they lie 1,000 miles from the cities of the eastern part of the Pampa, the centers which need fuel. Coal can be brought as ballast cargo from England or the Atlantic seaboard of the United States to Buenos Aires as cheaply as from Neuquén. But with better transport facilities between the Pampa and Neuquén, these deposits constitute a valuable resource of fuel-starved Argentina.

The lack of important coal resources in Argentina lends especial value to the oil-producing district at Comodoro Rivadavia in southeastern Chubut. Production dates only from the early years of the twentieth century, when men drilling for water for their flocks in the coastal desert struck a heavy oil of excellent quality. With the assumption of control of most of the developments by the national government, the aspect of the barren coast changed. In a waste of sand, the oil-derricks soon arose, and Comodoro Rivadavia has grown to a community of more than 5,000 people. Though the annual production of some 9,100,000 barrels (1928) does not fill more than a third of Argentine requirements, the field is an important source of fuels for the country. Gasoline refined from Comodoro Rivadavia oil by the government is sold in all parts of Argentina. Other potential producing zones lie in western Neuquén. These await suitable means of transportation; their situation differs greatly from the fortunate occurrence on the coast of the eastern field.

Argentine Patagonia can never develop an importance proportionate to its size, as compared with that of the Pampa or of the highlands of eastern Brazil. Nevertheless, to Argentina it offers a number of features not afforded by other sections of the country. It holds much of the future prospective sheep land, has considerable forest area, and produces practically all of the petroleum. Moreover, the scenic beauty of the Patagonian Cordillera augurs favorably for the future rise of a really significant tourist industry, supplemented as in Switzerland by continued attention to the raising of cattle. Remoteness and the absolutely desert character of much of the plateau constitute permanent limitations for the region as a whole, but sheep, forest, coal, water power, oil, and scenery denote progress for at least portions of this extensive southland of Argentina.

CHAPTER XXVII

THE PAMPA

The economic significance of the Pampa far exceeds that for any other natural region of South America. To Argentina in particular and to many consuming lands, it is of supreme importance. The statement "the Pampa is Argentina" has much truth, for the great eastern plain furnishes the major part of the 72 per cent of the world's exports of flaxseed which the country ships, the 66 per cent of the corn, the 20 per cent of the wheat and wheat flour, the 30 per cent of the hides and skins, the 26 per cent of the total meat and meat products, and the 54 per cent of the beef and its products. Upon this vast expanse of productive plains, the highly developed industrial regions of northwestern Europe have become increasingly dependent. Moreover, the ease of production and proximity to the sea send huge quantities of rawstuffs to the United States. As yet this area of approximately 250,000 square miles of the best agricultural land in South America has reached only a primary stage in its economic development, so that for the future the Pampa constitutes a veritable granary for the world.

The exceptional importance of these lands of Buenos Aires, La Pampa, Córdoba, and Santa Fé becomes even more striking when regarded in the light of the recency of their development. For centuries after the settlement of the lands about the Rio de la Plata, little large-scale exploitation took place. In earliest days especially, the Spaniards had little incentive to devote their efforts to a utilization of resources. Here no great stores of gold and silver awaited plundering—only great plains, carpeted with grasses, a vast tract of green, and infested with war-like Indians. Hence until the struggles for independence, the colonies of the lower Paraná lands chafed under the yoke of subordination of their interests to those of the mineral lands of the Cordillera. Finally, stimuli, afforded by a realization of the strategic site of the lands about Buenos Aires as the hub of Argentine activity and by the gradual growth of livestock industries

based upon the great herds grazing the grassland, gave the Pampa its start. Independence lent additional force to the movement and late in the nineteenth century, various factors contributing to progress over all the world brought the Pampa to the fore. Among the most vital of these factors, with regard to its influence upon the Pampa, was the development of refrigeration for the shipment of meats.

Whereas in the middle of the nineteenth century, the Pampa held scarcely one-third of the population of Argentina, the several conditions favoring its advance profoundly altered the situation by 1900. At that date, the Pampa supported easily more than half the national population, and in 1928 of the total Argentine peopling of 11,000,000, the "heart" region of the country had more than two-thirds. The city of Buenos Aires, metropolis of Argentina, alone has a population almost equal to that of all the country outside of the Pampa. To the stream of immigrants—Italian, Spanish, French, Russian, Turk, and German in greatest numbers—the east has served as an anchoring ground, particularly about the federal capital, so that fully one-third of the inhabitants of the Pampa are foreign-born.

Owing to factors involved in the need for adequate means for handling the enormous volume of shipments, the concentrating influences of seaports upon population, and the difficulty of obtaining a foothold in the interior because of the prevalence of large land holdings, the Pampa has most of its population in the cities. Buenos Aires, by reason of its manifold functions as port, federal capital, and financial and social center, has experienced a remarkable growth. Now the third largest city in the Americas, its population totals almost 2,500,000; in 1895, the figure was 663,000; in 1855, 90,000. Despite the handicaps of its inferior harbor, the port handles half the commerce of Argentina. The shipping district is a forest of masts at all seasons. Because of the congestion at Buenos Aires during the busy months, the city has lost some of its export trade, though it still retains supremacy as a receiving port. Rosario, affording better access to the most productive cereal districts, has taken over the exporting of most of the wheat, corn, and flaxseed, its 300,000 inhabitants depending to a large extent on this trade. The third port of the country has developed at Bahía Blanca to handle the rapidly increasing production of the southern Pampa. Here the harbor is one of the few good ones of the Pampean coast. Population as yet totals only

80,000 but increases rapidly. La Plata has 170,000 inhabitants, but promises little commercial growth as a port. Its chief function is that of capital for the province of Buenos Aires. Santa Fé, with 85,000 people, handles traffic for much of the Argentine northwest, while Paraná, across the river, serving the Entre Rios agricultural districts, has one-half the population of the larger port. The interior of the Pampa has no large center, but at the western margin lies Córdoba, a city of 180,000, a leading intellectual center and distributing point, which has built up important industries on the basis of hydroelectric power generated in the near-by Sierra de Córdoba.

In the growth of all of these cities, the ease of building railroads on the gently undulating plains has played an important part. Without the unifying influence of the rails and their utility in opening new territories to settlement, the Pampa progressed slowly. Today, in contrast, the region has the most highly developed railroad system in South America. Except for a tiny zone on the coast, no portion of the land lies more than 25 miles from rail facilities, a natural outgrowth in view of the heavy volume of freight furnished by the agricultural industries.

For the Pampa as a whole, an even more auspicious advantage than the rail system lies in the favorable proximity to the sea. Only by the accessibility of cheap sea transportation could the region have captured world markets. Moreover, the great river artery of the Paraná gives the richest corn and wheat districts direct ocean services. The poverty of harbors has made port establishment difficult in most cases, but the needs of commerce keep dredges working continually. Buenos Aires has particularly poor conditions owing to the enormous deltaic deposits of the Paraná River; nevertheless, the port has facilities for loading and discharging 1,500 vessels at the same time.

PHYSICAL SETTING

Relief.—The Pampa as a whole is among the most level areas of the world. In the hundreds of miles of plain the surface has an average rise of 5 feet per mile from the low cliffs on the coast to the west. In certain districts, the land is totally devoid of the slightest topographic break. For most of the area, however, the Pampa has a gently undulating relief, in which introduced trees and windmills stand out with astonishing clearness. Major interruptions to the

average landscape compose a small part of the total area; they comprise the rolling lands in middle Entre Rios, dunes in the west, and two low crystalline ranges in the south of Buenos Aires province. The easternmost of the two ranges—the Sierra de Tandil—rises to a height of some 1,500 feet, that to the west—the Sierra de la Ventana —to over 4,500 feet. On all sides the rocks give way to the unconsolidated materials of the plains.

Soils display less uniformity, though on the whole the light to dark brown, sandy to clay, loams have considerable fertility. Everywhere, however, the paucity of stones in the soil is conspicuous, so that the land offers a high degree of arability. The unconsolidated Pampean deposits extend to great depths. On this account the Sierras de Tandil and de la Ventana have especial value; their slopes support numerous quarries shipping granites, quartzites, and limestones to the stoneless plains. Much of the land has a surface of loess, the size of particles increasing westward; other districts are overlain by volcanic ash. The more arid west has developed large areas underlain by a zone of lime carbonate accumulation, the *tosca*, of great hindrance to agriculture. The most fertile soils of the Pampa lie in the rich "corn-belt" of northern Buenos Aires and southern Santa Fé; dark brown to black silt to clay-loam soils, they contain much humus, owing to the grass cover; they are free from stones and stumps (a boy in much of the Pampa could not find a stone to throw at a bird or dog even if he wanted one).

The peculiarities of the Pampa deposits, as well as the conditions of climate, make the region one of deficient drainage over large areas. Only three permanent streams of more than a few miles in length cross the plain (Fig. 164). For much of the land the rain waters merely soak into the ground, or as is the case particularly in the west where the *tosca* occurs and in the more moist far east, numerous pools of water hold the rains. While many of these are brackish, for the most part, they provide sources of water of considerable importance to the grazing industries. Of greater present value is the availability of ground water by the use of pumps; the windmill is ubiquitous on the Pampa. In the west waters of local infiltration generally prove saline, so that worth-while wells reach considerable depths.

Climate.—To the advantages of fertile soils and plains of low relief, climate adds further features inviting development of the land.

Though the far west is semi-arid and in certain years drought affects almost all of the region, the conditions of rainfall are decidedly benefi-

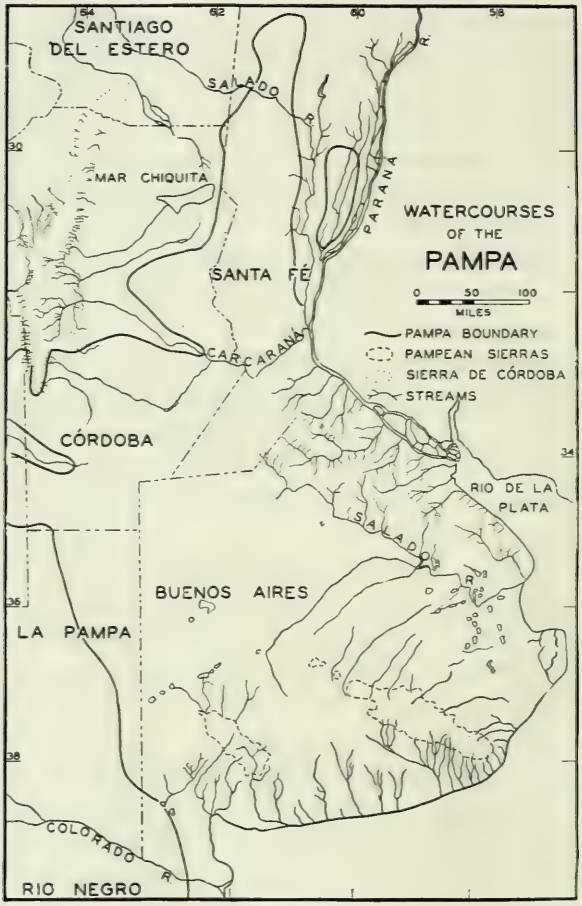

FIG. 164

From the Bermejo to the Rio Colorado, a distance of 1,000 miles only two streams cross the Pampa from the arid lands to the west to the sea—Rio Salado and Rio Carcarañа; note the many small streams in Buenos Aires and the lakes. (*After Inst. Geog. Argentina, Atlas 1886, Denis and Chavanne.*)

cial. Increasing in annual total from under 20 inches on the west to some 40 inches on the northeast the rains have a favoring seasonal distribution, summer receiving a definite maximum, while for much of the region winter is by no means a season of notable drought.

Moreover, the mildness of winter permits field work and outdoor grazing throughout the year. Zero weather is practically unknown on the Pampa. In the north the growing season averages 300 days, in the south, 140 days. The strong winds which find little interruption on the surface of the land constitute an additional element favoring industries, in that they make possible the use of the indispensable windmills.

Recurrent droughts are the principal shortcoming of the climate. The frequency of dry years is indicated closely by the great fluctuations in exports of cereals, though in some years excessive rainfall also has proved damaging. With the drought occasionally comes another devastating natural factor—the locust. Particularly in the north, the arrival of this scourge has presaged a poor year, for the insects devour practically all vegetation. So serious a menace does the locust constitute, that the federal government has made every effort to solve the problem of averting the too frequent invasions.

Vegetation.—To the character of its original plant life, the Pampa owes much of its importance. The great grasslands permitted easy travel, provided nutritious forage, and gave much fertility to the soil. Should a forest have covered the land rather than the sea of grasses, the Pampa most certainly could not have achieved its present economic significance since the arrival of the first colonists. Though as a whole the Pampa formation has undergone profound alteration by the spread of cultivation and the introduction of exotic species, the native growths still provide a rich resource for Argentina (Fig. 165).

The original cover—the *pasto duro*—consisted of various hard bunch grasses, chiefly of genera *Stipa* and *Melica*. These grow in isolated clumps separated by patches of bare ground. In the Pampa proper no trees existed, but at the east near the banks of the Paraná River grew the *ombú* (*Pircunia dioica*), a tree valuable chiefly for its shade, and the *ceibú* (*Erythrina cristagalli*). The moist swales support a far more varied group of plants, most of which are relished by livestock. Owing to the trampling of herds among other factors introduced by colonizations, over large tracts the *pasto duro* has given way to the *pasto tierno*, a more dense growth including a variety of soft annual grasses and leguminosae.

THE GRAZING INDUSTRIES

Although in recent years the products of the cultivated fields have surpassed the value of animal products exported, the Pampa owes much of its importance to the raising of livestock. Indeed, until the early years of the twentieth century the animal industries easily dominated the foreign trade; in 1894, the shipments of wool alone practically equaled those of all products of the farm, while the aggre-

FIG. 165. LOADING WOOL ON LIGHT RAILWAYS, BALCARCE

For a long time the leading product of the Pampa, wool still holds a significant place in the trade of the region; in the foreground a hard wire grass that replaces the Pampa grasses on over-grazed pastures; cattle avoid it. (*Courtesy of the Buenos Aires Great Southern Railway.*)

gate of livestock produce was almost three-fourths of the country's total foreign trade. Since the 1900's, the immense possibilities for the production of wheat, corn, and flax principally have led to a natural preponderance of cultivated products. Nevertheless, livestock in all parts of the Pampa are an integral part of farming systems, and in more than one-third of the area they still hold the leading place.

Cattle.—In 1816, a traveller, witnessing the hunting of wild cattle and horses for hides, remarked, "The real wealth of the province of Buenos Aires was, and always will be, the trade in hides." In 1922

the province pastured 15,507,000 cattle, more than 40 per cent of the total of the republic, which provided the bulk of more than 50 per cent of the world's exports of beef. In 1928 three-fourths of the beef exports of the country consisted of young chilled beef, the best commercial type, which enters the select English markets.[1] The quality of cattle steadily increases.[2] The improvement of the stock in the country has progressed most in the grazing region of Buenos Aires.

FIG. 166. ALFALFA RANGE, COQUETA ESTANCIA, ENTRE RIOS

A prime factor in the evolution of the cattle industry has been the enormous intrusion of alfalfa acreage for pasture; this pasture, seven years old, has few weeds and reaches the hubs of the automobile, covering the ground with a heavy growth.

Of the pure-bred types, the Durham, completely acclimated, is the most numerous. Yet in areas of harsher grasses and less favorable climate, the Hereford and Aberdeen Angus dominate.

Factors contributing to the improvement of the cattle of the Pampa include: the provision of ample pure water for the stock; the fencing of ranges and thus the separation of young animals, the breeders and the feeders; the importation of pure-bred stock for breeding purposes; and the conversion of native pastures into excellent alfalfa range (Fig. 166).

In the early days droughts were a double menace, for pastures not

[1] Beef exports in 1928 totalled 515,846 metric tons; 413,225 metric tons were high-class beef.

[2] CATTLE IN ARGENTINA

Year	*Native*	*Mixed Breeds*	*Pure Breeds*	*Total*
1888	17,574,572	3,388,807	37,858	20,001,237
1914	10,211,299	15,275,689	379,775	25,856,763
1922	6,492,019	29,549,234	1,023,597	37,064,850
1928	.....	.....	.....	34,410,000

only failed but the water supply gave out, causing the death of millions of animals. Now the tall windmills are a striking feature of the landscape. At the base of each a huge tank stores millions of gallons of water, which insure a water supply in periods of drought and at times when the windmills stand motionless for want of a driving breeze.

When cattle roamed at will, it was a difficult task, if not impossible, to regulate breeding. At present fine fences of seven to nine wires, the upper one or two barbed, on quebracho or *algarroba* posts 25 feet apart constitute an essential part of every *estancia*. With them the cattle are separated, graded and shifted from one range to another as indicated by the stage of the breeding cows and the feeders and by the condition of the pasture. Overgrazed areas are thus allowed to recuperate instead of having the cattle nip every new blade of grass as it appears above the ground; feeders are shifted repeatedly to better range as they approach marketable condition.

The importation of pure-bred stock for breeding purposes, first from the United Kingdom and later from the United States, lies at the base of the great evolution of the beef industry of the Pampa. Native scrawny, bony, creole cattle are fit only for extract, *tasajo*, or low-grade frozen beef; pure-bred cattle finished on alfalfa range dress into the best of chilled beef, which competes in the choicest markets with corn-fed beef from the United States.

Alfalfa, another factor of prime importance, has made profitable the use of millions of acres of land that otherwise would be relatively unproductive. The light porous soils of the middle Pampa are its best habitat, but it has spread far and wide (Fig. 167). It occupies more land than any other crop in Argentina, amounting in 1924 to almost 20,000,000 acres, or more than one-third of the land in crops.

Alfalfa has many advantages: (1) Good alfalfa pasture is worth about four times as much as the best combination of native summer and winter grasses. Normally, in Buenos Aires four to seven acres of native grasses support one full-grown steer, whereas alfalfa range supports one animal on every one and one-half acres. (2) Alfalfa, combined with year-around grazing, sends the steer to market a year younger than the native pastures. (3) From one planting it furnishes unexcelled forage for five to eight and even eleven years in some sections, and may be cut three times a year. (4) In late summer, when

native grasses dry up, alfalfa, because of its deep roots, remains luxuriously green. (5) Its nitrogen-fixing capabilities have enriched the soil of extensive areas. So valuable is it to the cattle industry of this region that on a single estate of 40,000 acres, more than half of the *estancia* may grow this flesh-making forage.

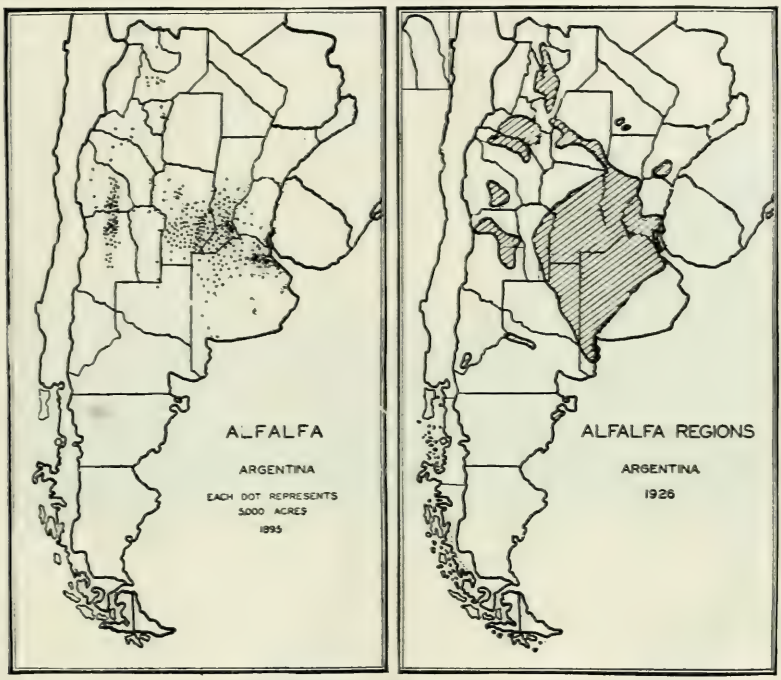

FIG. 167. ALFALFA REGIONS OF ARGENTINA

Alfalfa occupies more land than any other crop in Argentina; the alfalfa area in 1924 amounted to one-third the total area in crops. It does not grow in the eastern part of the province of Buenos Aires owing to vast areas of low, wet clay lands in the eastern margin and to a *tosca*, or hardpan, layer near the surface in the southern portion. The eastern limit of alfalfa is marked by a line from La Plata to Bahía Blanca.

Alfalfa is supplemented by other forage crops. *Cebadilla*, native rye-grass, and Sudan sorghum are wide-spread. Oats, sown during the latter part of the summer, supply green forage throughout the mild winter months; in the spring much of the crop may be left to ripen as a grain crop or as hay for reserve feed. Yet in the province of Buenos Aires nearly one-third of all the oats sown is used only for winter grazing.

Dairying.—Not many years ago Argentina presented the striking anomaly of a great cattle country, which produced little milk or butter. Before the war much of the urban population depended upon European condensed milk, tinned butter and cheese. The war cut off the source of supply, giving a great impetus to the domestic industry, which had been established in a small way in many parts of the country by Galician Spaniards, Basques, and Italians. Not only

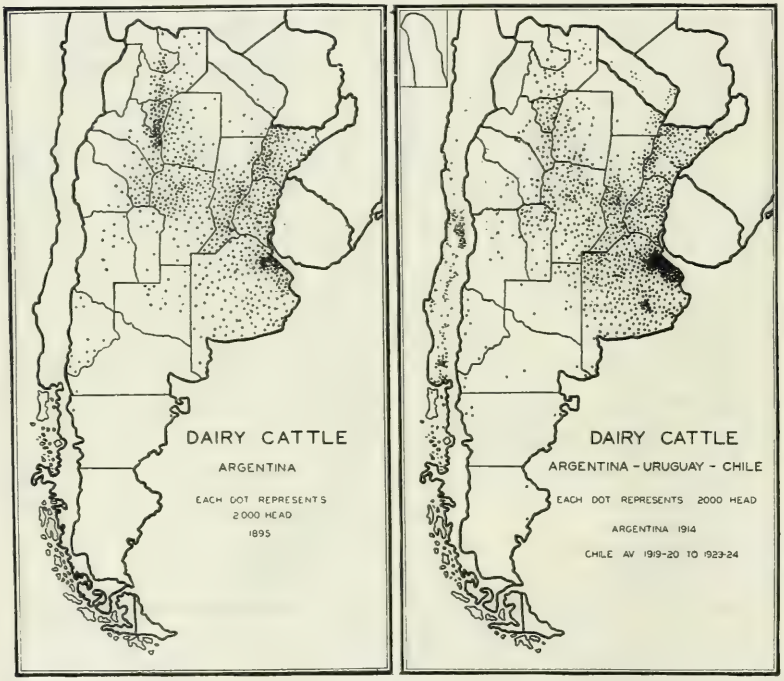

Fig. 168. Distribution of Dairy Cows in Argentina, Uruguay, and Chile

did the home industry supply domestic demands, but the exports rose to considerable figures.

Dairying has reached its greatest development in a small region, adjacent Buenos Aires, near a large domestic market and a great port, and in an area having rapid transport. Here a mild climate and an annual rainfall of about 40 inches evenly distributed throughout the year favor the growth during most of the year of luscious grasses, a prime factor in a high yearly yield of milk per cow. This small district has about 27 per cent of the dairy cows of Argen-

tina (Fig. 168); in it most has been done to improve the quality of the herds. Although Holsteins are the favored breed, Jerseys have been introduced. The region has one-third of the cream stations of the country, two-thirds of the butter factories, one-fifth of the cheese factories, and one-third of the combined butter-cheese factories. The province of Buenos Aires and Capital Federal produced, in 1920–1921, 73 per cent of the milk of the country, 78 per cent of the butter, and 66 per cent of the cheese.

FIG. 169. A MODERN DAIRY FARM, "LA MARTONA"

The huge *estancias* have provided the necessary funds with which to import, at great expense, the pure-bred stock that have elevated the quality of the animal in all parts of the Pampa; owners take great pride in the quality of such animals. (*Courtesy of the Buenos Aires Great Southern Railway.*)

While many dairies of the most modern type are quite common, in general, few cattle are housed. They graze in the pastures throughout the year, and are milked in large corrals. Cows always on luscious grasses give fairly high yields; yet high yields of milk have not become the chief concern of many dairymen, who consist of immigrants that have leased land on a large *estancia* for the production of milk. The dairyman contrives first to secure enough dairy products to make the leased land or farm pay as a dairy, while, at the same time, he trades in a small way as a pastoralist. With him a maximum yield of milk is not of primary consideration, providing that each cow rears a fine salable calf; the more cattle handled on a leasehold, the greater the income from this secondary source of revenue.

But a greater home market and foreign demand will bring about an improvement in the breeds, a greater output of dairy products, and a clearer distinction in the dairy type of farming (Fig. 169).

Sheep.—In 1840 the first shipment of wool left Argentina. During early years the vast areas of cheap temperate pasture lands and the small population in Argentina, with the increasing demand for wool to supply the textile mills of northwestern Europe, gave optimum conditions for the development of an extensive sheep industry on a gigantic scale. Moreover, wool, being easily prepared and transported to market without appreciable deterioration, gave a commodity suited to the means of transportation of the times. Most of the sheep were merinos; early they were of so little value for mutton that they were slain, the wool being pulled from the bodies, which were left for dogs and buzzards, or frequently burned as fuel.

The numbers of sheep increased rapidly at the hands of the Basque and Irish shepherds until near the close of the nineteenth century. In 1889 Buenos Aires grazed 51,000,000 sheep; in 1895, 52,000,000; in 1914, 19,000,000; and in 1922 only 12,902,000. At present sheep-grazing scarcely exists at the point where it had its origin in Argentina, in Buenos Aires to the east of Rio Salado, because crop agriculture and dairy farming near the centers of population caused sheep to seek the western and southern lands.

At present nearly all the sheep of the Pampa consist of mutton breeds; the substitution of the Lincoln for the old merino is complete. The former, originally bred on the moist downs of England, is well adapted to the wet eastern Pampa. Modern packing plants at the large ports have aided in driving the wool sheep to the far arid west and the cold south. Other breeds include the Romney Marsh, whose natural habitat was marsh land, Oxford Downs, and the Australian merino.

Hogs.—In contrast to the enormous numbers of cattle and sheep grazed on the Pampa, hogs number less than 1,500,000, concentrated principally in the corn-producing lands. The raising of the animals finds numerous favoring natural conditions, but various economic factors have hindered any great development (Fig. 170). On the one hand, mild winters obviate the necessity for shelters; the farms and packing plants lie near ocean ports; hogs may be raised more cheaply in Argentina than in the United States and pork products can be de-

livered to the eastern seaboard of the United States at lower prices than they can from Iowa. On the other hand, Argentina lacks a great pork-eating population to encourage increased feeding of corn and alfalfa to hogs. Moreover, the animals require far more labor than the Pampa can feasibly supply as yet; also farms with swine require expensive fencing. But a major handicap includes the large

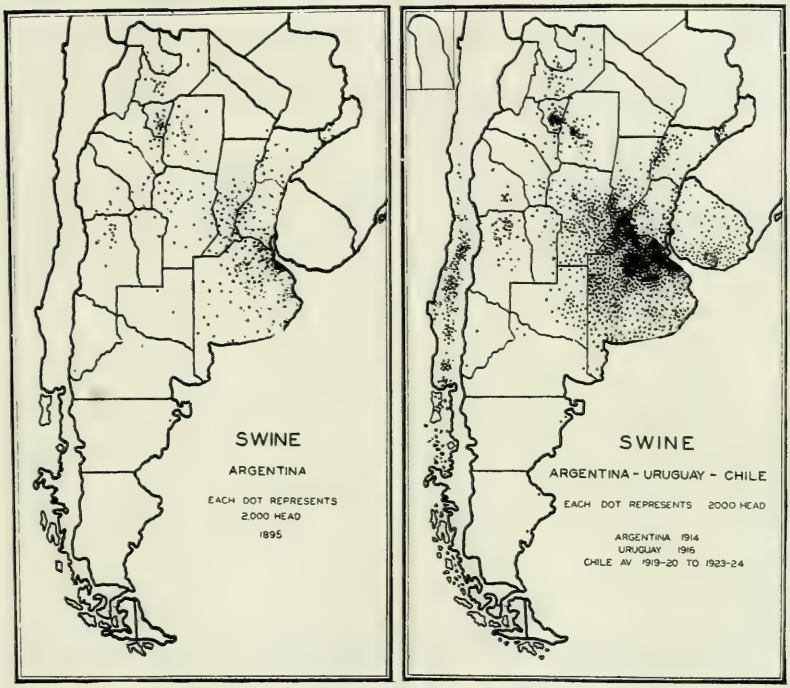

FIG. 170. DISTRIBUTION OF SWINE, ARGENTINA, URUGUAY, AND CHILE
The correspondence of swine distribution with the dairy and corn districts is striking.

number of hogs rejected at the packing plants owing to swine diseases; from farms under good management rejections are as low as 5 per cent, whereas on poorly managed estates rejections run as high as 50 per cent or more. Of course, as agriculture advances, some of the diseases will be eradicated.

The Estancia.—The huge profits obtained by the raising of cattle and sheep on an extensive scale and the increasing value of land have preserved most of the vast *estancias*, estates devoted primarily to the raising of livestock, from the inroads by agricultural colonists. At

one time, in the province of Buenos Aires more than 30 per cent of the best land was held by 93 proprietors. In 1917, 328 estates each embraced more than 25,000 acres. These large *estancias* afforded the necessary pasturage under one management. They gave, through the enormous profits from cattle or sheep raising on a gigantic scale, typical of the region, the funds sufficient to provide a comfortable *quinta* and living for the *estanciero* and all the members of his family, to educate the children in France or England, to furnish a luxurious *villa* in Buenos Aires, to introduce at great expense pure-bred stock, and to regulate breeding and grazing, prime factors in the development of the great pastoral industries.

Although corn and flax have invaded northern Buenos Aires, dairying and mixed farming the region east of Rio Salado, and wheat the southern and western part of the province, it seems that the great central and eastern portion is destined to remain primarily a grazing region of vast *estancias*, a land of excellent beef cattle and fine mutton sheep. Of low relief, the poorly drained lake and swale-dotted country, the clay loam and heavy clay soils, the even distribution of moisture throughout the year, the vast areas of alfalfa and the luxurious growth of native, lowland forage plants favor the grazing industry and hinder the expansion of farming. Vast areas may be drained, but it will be a long time before economic pressure brings about large drainage projects. The landed aristocracy, a small class having wealth, leisure, and power, does not want the agricultural immigrant, while the native laborer in this region prefers a life in the saddle to one of hard labor in the fields. Thus geographic, economic, and social conditions point to the permanency of sheep and cattle in this part of the Pampa.

CROPS

Those physical factors favoring the great development of livestock industries in the Pampa contributed also to the excellence of the region for the production of crops. Fertile soils, enriched by the humus of the grass cover, contain practically no stones or stumps. The exceptional levelness of the surface permits machine cultivation in all parts of the plain, although in the east considerable areas of periodically swampy land to some extent prevent the use of large machinery. Climate in general proves highly favorable, particularly for corn and flax in the north, the former west of the Paraná, the

latter to both sides of the river, for wheat over most of the west and for oats, barley, and rye in the south. Moreover, proximity to the sea affords Pampa crops a great advantage.

Wheat.—The great wheat lands of the Pampa extend in a vast crescent for some 600 miles from southern Buenos Aires to central

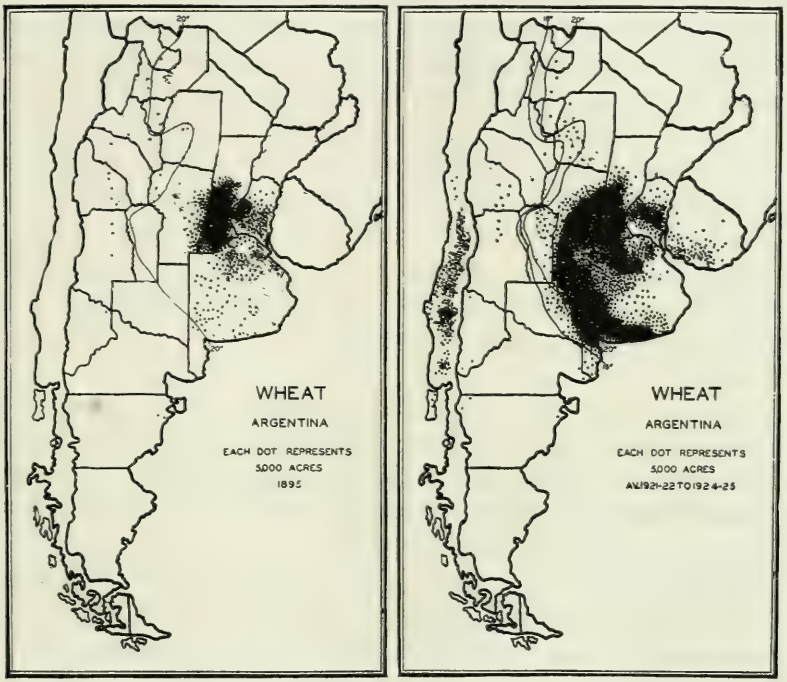

FIG. 171. DISTRIBUTION OF WHEAT IN ARGENTINA, URUGUAY, AND CHILE

Since 1895 wheat in Argentina has extended from a concentrated area of the colonies in southern Santa Fé to nearer the physical limits of profitable culture. What limits its culture on the west? The north? The east in Entre Rios? Why has it avoided the lands of eastern Buenos Aires?

Santa Fé and eastward in to central Entre Rios (Fig. 171). Although these lands which produce the most valuable single export commodity of Argentina are predominantly the zone of wheat sower and harvester, they support other important industries also: cattle and alfalfa everywhere; oats and barley in the south; corn and flax in the north. In its western portions, the zone of intensive wheat cultivation is clearly marked by the mean annual isohyet of 20 inches, while that of approximately 16 inches denotes the extreme present limit of the crop.

The soils of the wheat crescent consist mostly of fertile friable types favoring extensive cultivation of the cereal. In the southern third of the crescent, in east central La Pampa and southern Buenos Aires, the soil consists of dark brown silt loam to heavy clay loam, 12 to 24 inches in depth, overlying cherty limestone, and having a high water-holding capacity. In western Córdoba a fine sandy loam, a wind deposit, over heavy clay gives a fine wheat soil; in eastern and northern Córdoba, the northern part of the wheat area, it is a dark brown clay loam underlain by a hardpan from a few inches beneath the surface to 35 inches or more; the hardpan layer does not prove especially harmful to wheat except in dry years. In the central section of the crescent—in northwestern Buenos Aires and southeastern Córdoba—sandy swells, excellent for alfalfa, rise a few feet above the general level of the land, a condition expressed in the wheat and animal maps. So fertile and workable are the soils of the wheat crescent that only the corn-flax region surpasses it in land more suitable for crops.

Owing to various intra-regional differences in climate chiefly, four districts of wheat stand out, each characterized by distinct varieties: the northwest in *Barletta* wheat, the central and southern sections for frost-resistant types, and the southwest, the coolest and driest portion, for the Russian and Kanred wheats.

Barletta, brought from Italy, resembles the Turkey Red of Kansas, although the grains are softer and the quality not quite so good. It will remain in mature condition on the stalks for a long period without being shelled out by high winds. It best combines the qualities resistant to severe droughts and rust, extreme heat and cold, damp, and fogs. The Russian, well adapted to the climate of the southern part of the region, matures early and gives a high gluten content, but when ripe it shells out easily and does not lend itself to a long harvest period by the combine. The Hungarian wheat, a hard variety, cultivated in western Buenos Aires does well on sandy soils. It yields better than other varieties of better quality, but which demand more fertile soils and more care in cultivation. The Lombard, or Italian wheat, is well adapted to the climatic conditions of the central and northern portions of the wheat region, although its cultivation is not extensive. *Candeal,* the chief durum wheat of Argentina, yields well in the central and western portions of the province of Buenos Aires.

Also it is cultivated in Entre Rios. *Tagan*-rock, a hardy durum wheat resistant to diseases, does not shell out easily and is cultivated in the same areas as *Candeal*. *Kanred* wheat, recently introduced, seems adaptable to sandy, rather infertile, and droughty soils.

Extensive wheat culture is well suited to the physical conditions in the region. The mild winters and the moist springs promote the proper stooling of the wheat, while the dry, sunny, ripening period favors the early maturity of a hard wheat of high gluten content. Also the dry harvest period and the almost level land permit the use of large harvesting machines during a long harvest season.

Methods of Production.—Wheat is grown by three types of farmers: the *medianero,* or share-worker, the colonist, and the *arrendatario,* or tenant.

On the large land holdings of *estancieros,* who are reluctant to divide their immense estates, *medianeros* contract for a piece of land for wheat growing. Often the farmer, most frequently an Italian, contracts to farm 400 to 500 acres. The landowner may furnish the horses, the machinery, and the seed; at the end of the season he sells the wheat and the net proceeds are divided, as a rule, evenly between the farmer and the landowner, the former of whom dwells with his large family, most of whom labor on the farm, in a grass-thatched or sheet-iron-covered mud hut. Usually he remains in one place only a few years. He tills the land in an extensive manner, resulting in low yields per acre and rapid deterioration of soils. Yet a decade ago it was estimated that family labor of this type produced three-fourths of the wheat crop of Argentina.

In the northern part of the crescent many colonies of Italians, Swiss, and French established by great leaders began the cultivation of wheat. In the department of *Las Colonias* in southern Santa Fé the colonies were described in 1882 as a vast lake of wheat; of 317,500 acres of cultivated land in Santa Fé in 1882, 280,000 grew wheat. This section today is the area of greatest production, with 40 to 50 per cent of the total land area in wheat.

Arrendatarios, who possess sufficient funds for equipment rather than to farm on a small scale, prefer to rent land and farm on an extensive scale. They rent from 25 to 750 acres or more, employing machinery they have purchased, and pay rent in the form of part of the crop or in cash. They live in crudely constructed huts, make no

improvements, and farm one crop extensively. They do not grow even the fruits and vegetables for home use. Over most of the region shallow plowing is the rule, although in some sections a deep plowing in February or March may be followed in May or June by a shallow plowing or disking, which increases the yield after a few years of cropping. One or two harrowings across the furrows prepare the land for wheat.

While large drills are becoming common, much of the grain is sown with broadcast seeders or by hand. In the region of the colonies in Santa Fé the seed is sown in panels from 200 to 260 feet in width and 2,600 to 3,300 feet in length. A harrow drawn at right angles to the furrows covers the wheat. As the best seed is sold, the percentage of germination reaches only 50. The season of seeding extends from May in the north to August in the south.

From November to January headers, binders, and combine harvester-threshers harvest the grains. Headers are used chiefly in Santa Fé and Córdoba, binders in northwestern Buenos Aires and in Entre Rios, and combines in southwestern Buenos Aires, where labor is most scarce and where types of wheat and climate are best adapted to them. The grain cut with binders is threshed from the shock, that with headers is generally stacked with one covering for late threshing, while the combine performs the cutting and threshing in one operation, dropping the grain in bags as it proceeds across the field.

The stripper-harvester has many disadvantages, but the rapidity with which it accomplishes the task and the saving of labor increase its use. It requires certain conditions for successful operation: level land, grain thoroughly ripe and dry, non-shattering grain—*Barletta* is especially suitable—a dry, sunny harvest period without winds so that the grain will remain standing, and dry firm fields at the time of harvesting and threshing. Periods of rainy weather at harvest time may cause huge losses, as the wheat may fall or as machines mire down in the fields. The combine moves from *estancia* to *estancia,* doing the work of harvesting on a percentage basis, usually one sack out of three.

Despite the employment of the best of labor-saving machinery, the huge harvest calls for thousands of laborers for whom Argentina can provide no work at other seasons. The migrations of Italians and a few Spaniards, at the close of their harvests at home, to garner the

golden grain of Argentina has amounted in recent years to 180,000. These so-called *golondrinas*, or swallows, consist of hard-working men, who live on little and reap the high wages of the Argentine harvest; they supplement the work of the *peon* who prefers a life in the saddle to one of manual labor and by their departure for home they relieve the labor market of a burden during the slack season.

Yields of wheat are only moderate; Argentina has a yield of only 12.1 bushels per acre (average 1922–1925) compared to that of the United States of 14.2. Improvement over earlier years increases; the average yield for 1909–1913 was only 9.2 bushels. Poor agricultural methods in many sections, owing to lack of skill and initiative on the part of the *medianeros*, *arrendatarios* and even the landowner, droughts, frosts, heavy rains, and locusts induce low yields. La Pampa best illustrates the effects of drought and frost, Córdoba and Santa Fé of locusts, and Santa Fé of rains at harvest time. Heaviest yields are obtained in Buenos Aires, 12.4, and the lowest in La Pampa, 9.5.

Movement of the Crop.—Huge two- or four-wheeled carts with wheels frequently 8 feet in diameter transport the grain from farm to railroad. Loaded by hand, each holds from 4 to 6 tons of wheat sacked in jute bags of 136 to 143 pounds. Regular teamsters, who base their charges on the length of the haul and the condition of the roads, handle much of the wheat as well as other grains. The average haul is 9 to 10 miles, and the maximum which still yields an ultimate profit, 25 miles. At the stations the bags, stacked in immense heaps, frequently in the open, are covered with waterproof canvas.

Without navigable rivers, the wheat region depends upon a fair network of railways, although different gauges exist and some sections lack feeder lines. The region lies near the sea compared to the wheat regions of the United States,[3] but the rates are high; yet the short rail haul gives Argentine wheat an average margin of 8 to 10 cents per bushel over American wheat in the combined rail and ocean haul to Liverpool.

Wheat in Argentina, in contrast to that in the United States, is primarily an export crop, two-thirds of the production going to

[3] Nowhere is the haul to one of the ports more than 391 miles; very little grain anywhere in Argentina is transported more than 300 miles.

foreign markets. The sparse population of the country and wheat farming on an extensive scale with labor-saving machines of all kinds enable the country to produce a large surplus, and the location of the region within 300 miles of a river or an ocean port means low transportation costs compared to those of Canada or the United States, where the export wheat grows 1,000 miles or more from the sea.

Expansion of Wheat Culture.—Wheat production in Argentina has large possibilities; it will not be confined to the wheat crescent; it spreads over into most of the adjacent regions. Argentina has 225,000,000 acres physically adapted to wheat culture; with 30 per cent of this land yielding wheat at 13 bushels per acre, the country could produce 900,000,000 bushels. While the country has large possibilities, a long time will elapse before its crop mounts even to two-thirds of this figure. For years most of the crop will come from the present wheat crescent.

Corn.—Corn, the chief crop of northwestern Buenos Aires, southern Santa Fé, and eastern Córdoba, has spread from Rosario into the domain of pure-bred cattle and into the wheat lands. As yet, it has not penetrated the area east of the Paraná River, owing chiefly to the lack of adequate transportation facilities. The "Corn Belt" of Argentina, by its location on the Paraná, has easy access to the Atlantic, a marked advantage over the Corn Belt of the United States, most of which lies 1,000 miles or more from the sea. Although this zone is only 120 miles wide and 250 miles long, with an area of about 30,000 square miles, its chief products—corn and flax—have lifted Argentina to first place as an exporter of corn and linseed (Fig. 172).

On the whole the annual rainfall of the corn lands of between 30 and 40 inches proves sufficient for the crop; an early summer maximum during November to January of 9 to 12 inches gives highest yields; but a second maximum coming in March and April, at ripening and harvesting period, combined with mild temperature causes a great deal of the corn to spoil in the field, in the *troje* or en route to the sea. Here drought is an even greater threat than in the case of wheat. The locust emphasizes the menace of a dry season more for corn than for any other Pampa crop. Coming from the Chaco and the *monte*, from north and west, the insect arrives when corn is most susceptible to attack, at the time when the plant is green and the ears soft. Corn is the favorite diet, for wheat has ripened and flax usually has been

harvested. Summer temperatures for the corn region average 71° F to 75° F; the growing season extends from November to late April. Winters are mild, permitting plowing throughout that season.

Of all sections of Argentina, the corn region has the largest number of products contending for the use of the land: they include corn, wheat, flax, alfalfa, cattle, and swine; but corn predominates. Of the acreage in crops in this area, corn occupied 52 per cent in 1924–1925; in the zone for 50 miles west of the Paraná corn occupies nearly two-

FIG. 172. SHELLING CORN

Stored in a wire-corn or cane-stalk *troje*, corn keeps well in dry weather, but in damp seasons a great deal may spoil, because of insufficient aëration and of high temperatures. Shelled corn is stored in sacks in huge piles in the open awaiting transportation to railway and port. (*Courtesy of H. G. Olds.*)

thirds of the entire area; the acreage of corn in this region constitutes 68 per cent of the area planted to corn in the republic (Fig. 173).

The corn of Argentina consists almost entirely of the flint type, which has a marked preference in the markets of northwest Europe, although it may sell for 8 to 10 cents more per bushel than that from the United States. This preference results from: smaller kernels, making it better adapted to poultry feeding; sweeter meat, making it in demand for horse feed; and 3 to 4 per cent less moisture, so that it ships well and will keep in good condition longer.

Argentine flint corn consists of two types: white and yellow. The white varieties, *Morocho* and *Perla*, are not so widely cultivated as the yellow. *Morocho* has smooth, flinty kernels, much smaller than the

white dent of the United States, while *Perla* grows ears and kernels one-half the size of *Morocho*. *Maiz de harina*, flour corn, having light yellow kernels and very starchy, grows in the north. Other yellow varieties include *Canario*, *Hungaro*, *Cuarenton*, and *Lombardo*.

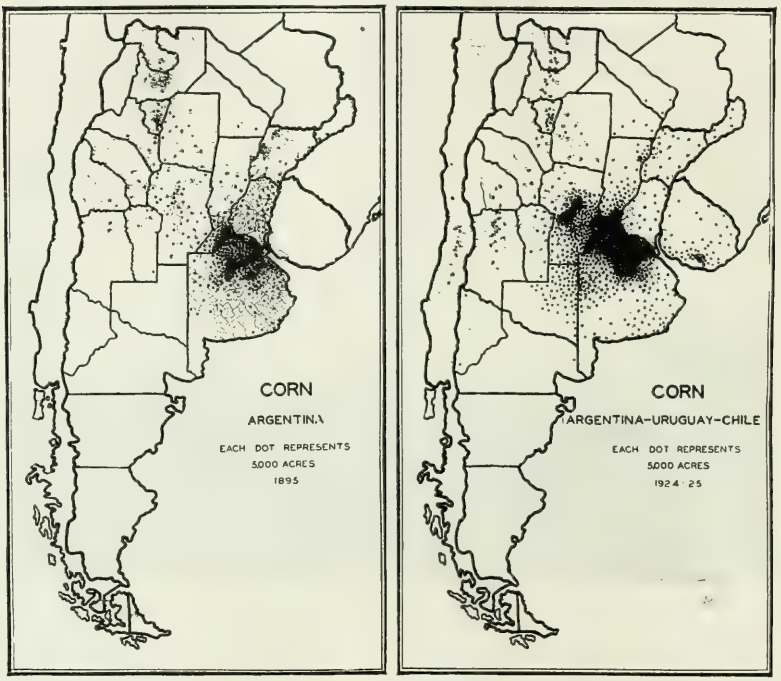

FIG. 173. CORN AREAS

The region which corn dominates in Argentina extends for only 120 miles to the west and south of the great bend of the Paraná; though it may be grown in many parts of the country, nearly all of the crop comes from land within 200 miles of ocean transport.

Cuarenton, with a small flat kernel of fine appearance, dominates; it is unexcelled as poultry and pigeon feed.

In spite of a preponderance of the flint varieties of corn the dent types have been introduced; they are adapted to the climatic conditions of the region and give high yields, although they require several more days in which to mature. Yet they are better for hog and cattle feed than the flint varieties.

Flax.—Argentine linseed is by far the world's most important source of the basic raw stuff of paints. The great profits yielded by the production of flax have made the crop a prominent one, princi-

pally in the zone of corn where in certain districts its acreage may equal or surpass that of corn. Especially in Entre Rios has it come to the fore as a main crop. It is produced especially as a first-year crop in preparation for alfalfa range. It is especially valuable for the latter use for several reasons. Its drought- and heat-resistant qualities

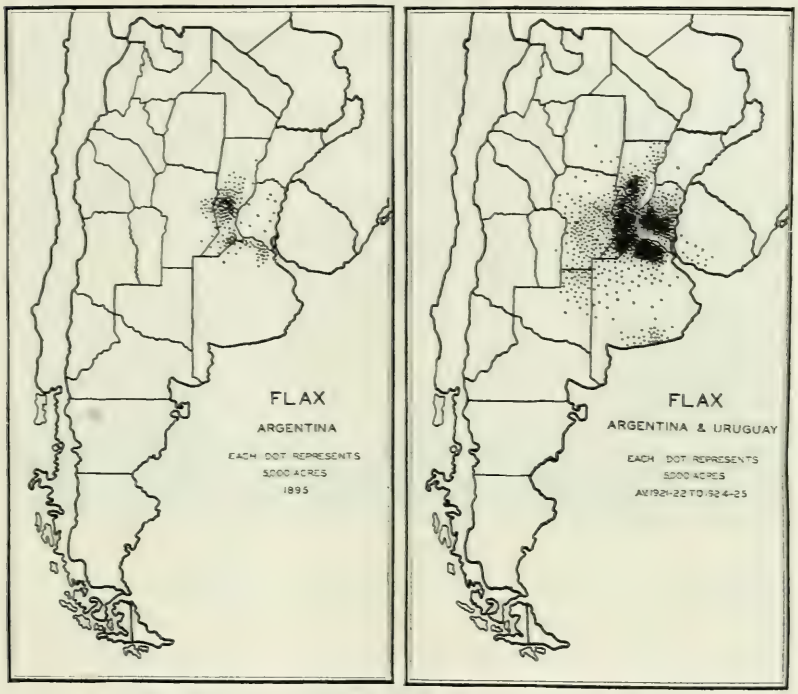

Fig. 174. The Distribution of Flax in Argentina-Uruguay

make it an admirable crop for the Pampa. Yields are high—10 bushels per acre in the corn-flax region, a 20 per cent greater yield than in the United States. Its short tap root creates a heavy drain upon the fertility of the upper soil and its liability to disease further favors its culture on range land. Furthermore, wealthy landowners wishing to increase their acreage of alfalfa, rent land for three or four seasons for flax culture to immigrant farmers, who at the end of the period leave the land in alfalfa—a cheap way of getting alfalfa pasture (Fig. 174).

Truck Crops and Fruits.—Though most agricultural establishments have their garden patches and a few fruit trees, the production of

vegetables and fruits has become localized in a strip about 50 miles wide from south of La Plata to the north of Buenos Aires. This district as a whole is one whose boundaries, products, and types of farming are determined by economic factors, rather than any difference in physical conditions, except possibly in the small area in the delta of the Paraná. In relief, soil, and climate the land is similar to the great expanse to the west. But location, transportation, and market create in the coastal strip a different agricultural economy. Many vegetables—potatoes, cabbage, peas, lettuce, beans, tomatoes, radishes, and others—are produced in large quantities within a few miles of the chief cities of the region. On each day of the week one or more of the town market places is a scene of bustling activity as the gardener disposes of his products. The growth of vegetables for the city market is the only type of farming in both Argentina and Uruguay where the small farm with rather intensive methods prevails. The gardening areas with farms of a few to twenty-five acres or more string out from the cities along the chief railways or lie around the suburban towns. Owing to fertile soil, long growing season, and an even distribution of moisture throughout the year, green vegetables may be supplied for much of the year. Nowhere in this region has a canning industry developed to provide a winter supply.

As with vegetables, most of the fruit except grapes and citrus fruits is produced in this region. The more important fruits include peaches, quinces, apricots, plums, cherries, medlars, pears, and apples. In general, they are grown on large estates by immigrant labor or on farms of 25 acres or less in the suburban areas of Buenos Aires. Four-fifths of all the fruit trees in Argentina lie within 200 miles of the metropolis. Few sections of this area present ideal conditions, for the rich but low and only fairly well-drained areas, subject to late spring frosts and high autumn winds, hinder fruit culture. Therefore, specially favored protected spots, along the river, produce the fruit. They include, in order from south to north along the Rio de la Plata and the Paraná, La Plata, Guilmes, San Fernando, Tigre, Baradero, and San Pedro. The greatest area of all consists of the Tigre, the low island district of the delta of the Paraná. Some of the island district artificially made and drained, although subjected to overflows by high waters and by the tide, favors fruit production on account of its freedom from frosts. Also, it lies less than 100 miles

from Buenos Aires by rail or water. In contrast to other districts the fruit plantations of the delta, although not always in one unit, but owned by one individual or a company, range in size from 200 to 800 acres. The plantations grow the willows or poplars from which to make baskets, crates, or cases for fruit containers. Methods of planting, cultivation, and pruning are similar to those in the United States.

Fig. 175. Frigorífica La Blanca, Buenos Aires

One of several huge packing plants in the Pampa; a constant procession of high-grade cattle, fattened on alfalfa in the Pampa, and of poor cattle from other regions produces more than half the beef exports of the world; packing is one of the chief manufacturing industries of Argentina.

MANUFACTURING

While the Pampa is an agricultural land *par excellence*, by the very token it has developed only an elementary manufacturing economy. Lacking near-by forests, iron ore, or other metals, and fuels, the region, or the country as a whole, has little conducive to basic industries. Argentina imports three-fourths of the manufactured wares consumed by its population. Nevertheless, a domestic population of 11,000,000 and a tremendous volume of exports impel the rise of certain activities. The country has about 61,000 manufacturing establishments, which utilize 1,000,000 horse power, employ 600,000 laborers, and produce commodities valued at 1,200,000,000 dollars. An exceptionally high protective tariff has exercised great power in enabling certain enterprises to develop. Others of the industries

require no protection, for they represent logical localization; these include the meat-packing and flour-milling groups (Fig. 175).

The enterprises devoted to the preparation of agricultural products prior to shipment abroad have reached the largest proportions among Argentine industries.[4] An annual export of 1,500,000,000 pounds of prepared meats denotes a considerable packing industry. Some of the meat-packing plants, under American or British capital, are among the largest in the world. The milling industry and the preparation of dairy products are also of great importance.

For domestic needs, a large variety of minor industries operate, most of which require the heavy protective tariff. In addition to the production of animal and crop commodities for use in Argentina, manufactures include textiles—cotton, wool, and silk—various metal-working plants using imports of iron and steel (700,000 tons in 1927), a progressive leather and shoe industry, breweries, tobacco factories, and the long list of articles needed to meet some of the needs of a population of several millions.

Owing to the concentration of population and transportation facilities, the seaboard cities support the only considerable industries.

[4] Manufacturing Industries in Argentina

Industry	*Year*	*Number of Establishments*	*Capital Invested (Millions of Dollars)*	*Value Added by Manufacture (Millions of Dollars)*	*Value of Products (Millions of Dollars)*	*Number of Workers Employed*
Beer	1926	20	28.5	24.4		5,690
Boots and shoes	1926	155	10.5		24.4	10,500
Chemical	1926	23	3.7		4.4	1,000
Dairy (cheese and butter)	1927			13.8	31.5	
Flour	1926	188 (a)	37.5	26.5	122.7	
Glass	1925	12	7.9		9.8	
Hat	1925	31	9.4		5.6	2,753
Meat packing	1927		160.	32.8	195.2	
Petroleum (refineries)	1928	15		19.8	(b)	
Quebracho	1927			6.3	21.5	
Sugar	1928	40		36.9		
Textile	1927	139	26.2		28.2	10,850
Tobacco and Cigarettes	1927			46.		
Wine (*Bodegas*)	1927	2,461		37.		

(a) Mills in operation; the census of 1914 gave 408 mills.
(b) Capacity 50,000 barrels daily.

Most of the figures are estimates; no census of industry has been taken since 1914; compiled from many sources.

Though Buenos Aires has practically all of the important developments, considerable progress has occurred in Rosario, La Plata, Zarate, Bahía Blanca, Campaña, and Santa Fé.

THE FUTURE

For many decades the Pampa will follow present trends in its major industries. As from early times, a grazing and crop land, the Pampa and even the entire country will continue as a surplus region of the products of the farms and ranges and an importer of manufactured wares, because of a lack of the basic raw materials for a large industrial development. The great plains have far to go before closely approaching maximum utilization in any one agricultural activity. Wheat, corn, and flax have taken over only a small part of the areas to which they are suited, while the cattle industry has vast possibilities in the quality markets of northwest Europe. Moreover, improvement in methods of producing and handling the grains particularly will give these commodities increased competitive power and also will contribute to the continued parcelling of the *estancias*. All of the tendencies can come about only gradually. While comparatively large, immigration populates the agricultural lands slowly; the cities hold back a large number. This great domain, practically equal in area to Ohio, Indiana, Illinois, Iowa and Nebraska, has opportunity for a future agricultural development of titanic proportions.

CHAPTER XXVIII

URUGUAY

In many respects, Uruguay is unique among the countries of South America. Despite a rank as the smallest republic of the continent, its 72,150 square miles afford an expanse of readily utilizable land which in point of ratio to total area gives a premier position to this wealthy territory. Here and there marshy strips along streams, rocky ledges, and sandy wastes constitute unproductive districts; but in the aggregate, almost 90 per cent of the total area of the country consists of productive lands in stock-raising and agricultural establishments. Moreover, in proportion to its territorial expanse, Uruguay has the best transportation facilities of all South American countries. No mountain barrier rises between the interior and the sea. The ocean, the Rio de la Plata, and the Uruguay River place more than half the national boundary in direct contact with cheap water transportation. In addition, 1,800 miles of railway, uniform in gauge, radiate from Montevideo to various parts of the republic.

Population contributes also to the list of factors that guarantee prominence to the diminutive country. Uruguay has a purer European population than any other South American country. Owing to their intractability, the scattered groups of native Indians suffered virtual extermination. Hence the present day peopling of 1,720,000 comprises 90 per cent dominantly white, 8 per cent mestizo, and 2 per cent Indian and negro. Montevideo, actually the hub of economic activity for the republic, because of focal location and its administrative functions, has more than one-quarter of the national population. The progressiveness encouraged by a rich land secures further stimulus in a standard of literacy rivalling that of Argentina.

With its national economy restricted almost exclusively to agricultural industries, the country nevertheless vies with Peru for fourth rank among the commercial leaders of the continent. Here the products, principally of pastoral industries, furnish the basis for a total

foreign commerce of some $200,000,000, so that in per capita trade the republic holds second place among South American countries.

A stormy career as an early buffer state tended somewhat to retard the advance of Uruguay. Its strategic location induced long strife between Portuguese on the north and Spaniards on the southwest. Subsequently until the early years of the twentieth century internal strife prevented any important development of natural potentialities. Following the cessation of political difficulties, the country turned to the development of its resources, a change which has resulted in its rise to present eminence as a firmly established nation.

PHYSICAL CONDITIONS

Uniformity of conditions, exceptional among South American countries, prevails in both the physical and cultural aspects of Uruguay. Though such lack of diversity fosters the rise of agriculture, it also denotes a distinct shortcoming relative to future capability for developing a sound combination of national industries and for lessening dependence on foreign markets. For all practical purposes, Uruguay possesses no wood or coal, and its rolling topography fails to provide any great source of hydro-electric power. The full force of such deficiencies, however, has relatively little import at the stage of development now obtaining. In its pastoral industries of the present, the country realizes to a great extent the advantages gained in its physical constitution. Moreover, the production of crops, an occupation scarcely prospected as yet, affords the basis for a long period of progress in national industry before manufacturing becomes a truly vital need. The proximity of Montevideo to the principal center of population of South America and its importance as a port-of-call tend further to postpone the time of widespread interest in domestic manufacturing.

Relief.—From rather bold ranges and broad tablelands of 1,000 feet elevation in northern Uruguay, elevation and relief decrease gradually to the shores of the Rio de la Plata and the swamps of the Uruguay. Level *mesetas*, high rock ridges, deep valleys, and even rock-strewn surfaces, stone huts, and stone corrals of the north give way to broad, gently undulating, stone-free, grass-covered swells that stretch from horizon to horizon and rise and dip with a ceaseless regularity in smiling folds of land, dotted here and there with the adobe hut of the shepherd and the fence or stake corrals (Fig. 176).

Though in general a land of undulating subdued relief two major portions may be indicated. The northwestern two-thirds of the

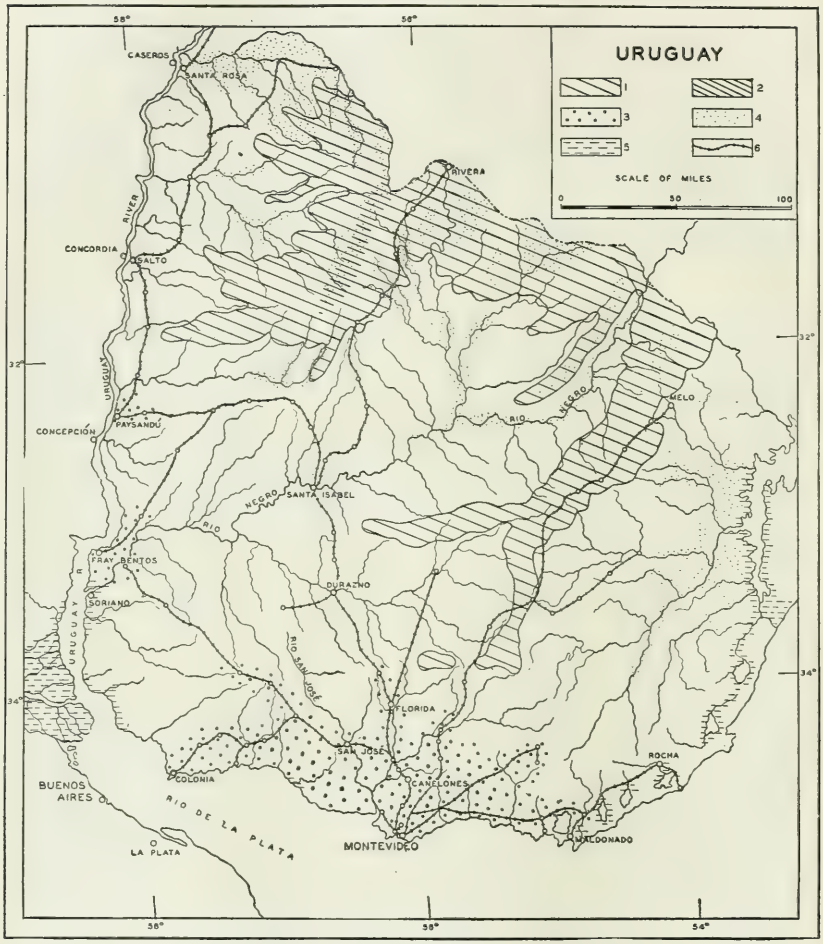

Fig. 176. The Republic of Uruguay

The rolling well-drained land with a favorable temperature and rainfall régime constitutes a great grazing country; (1) highlands 600 to 1,500 feet above the sea, (2) 1,500 to 3,000 feet above the sea, (3) the principal farming districts, (4) the forested areas, (5) swamps, and (6) railroads.

country embraces the characteristic rolling, well-drained, dissected, grazing lands. But in the south and southeast, in a zone extending from the Uruguay River to Lake Mirim, alluvial deposits transported

by the numerous streams and æolian materials, corresponding to those of the Argentine Pampa, occasion a land surface and a utilization of that surface different from conditions in the northern districts. Fertile and close to the sea, these lands in the departments of the Rio de la Plata littoral produce most of the crops of Uruguay. Along much of the coast tracts of dunes have developed, utilized chiefly as areas for the planting of pine and eucalyptus both to prevent migration of the sands and to establish a supply of wood.

Climate.—Lying between latitudes 35° S. and 30° S. the region constitutes a border zone between temperate and tropical climes; nowhere do freezing temperatures arrest for long periods the growth of grasses. Yet the short, mild winters interrupt the great heat of summer as do diurnal changes. Mean summer temperatures range from 72° F to 80° F; in the northwestern part of the country summer temperatures may reach 106° F, but usually constant refreshing breezes alleviate the oppressing heat of the summer day.

The distribution of an annual total generally between 35 and 60 inches of rain possesses favorable uniformity, although the number of rainy days is small. Year to year variations, however, may be considerable. No section of the country receives an average less than 6 inches in any three-month period. Moreover, prolonged droughts menace the country considerably less than in the Pampa. As in the cattle lands of Argentina, temperatures permit the grazing industry to dispense with shelters, although to the north the warmth and moisture make tick-infested areas of much of Uruguay.

Vegetation.—For the purposes of the pastoral industry, the extent of grassland is highly advantageous. Of all South American countries, Uruguay has the smallest percentage of land in tree growth. The strips of arborescent forms which line the watercourses and which in cases may attain forest proportions, as in the district of the lower Rio Negro, and the patches growing in the higher north occupy only 3 per cent of the total area.[1] Elsewhere predominate the *Gramineae* which have so favored grazing; grasses include on the ridges mostly bunch types belonging to several genera, *Stipa, Aristida, Andropogon, Panicum,* and others; in the swales of the undulating prairie a continuous turf of fine grasses and herbs prevail.

[1] Why is Uruguay a grassland with so much rainfall?

URUGUAYAN AGRICULTURE

Agricultural activities maintain the standard of uniformity established by relief, climate, and vegetation. Only in the southern departments of Colonia, San José, Montevideo, Canelones, and Maldonado, where cultivated crops have displaced livestock on the fertile alluvial soils, does the pastoral aspect of the country lose predominance. Otherwise, fully 80 per cent of the total area is devoted to the grazing of cattle and sheep and produces nine-tenths of the total

FIG. 177. MIXED NATIVE CATTLE

Though most of the cattle of Uruguay still consist of medium- to poor-grade stock, many owners in the southwestern part of the country have high-class stock built up from pure-bred imported animals. This movement will increase the output of high quality meats. (*Courtesy of the Pan-American Union.*)

exports. Hence Uruguay has become a land of relatively sparse population of 18 persons to the square mile (exclusive of Montevideo) and of extensive land-holdings. On the whole, however, here the *estancia* tends to average smaller than in Argentina, owing to the advantages afforded by the handling of smaller herds. All of the rural lands are divided among 43,000 properties. Rather than take to laborious tasks on the farm with hoe or plow the sparse population harbors a traditional preference for a free and open life on the cattle and sheep ranges.

The Cattle Industry.—Though a development of the last 50 years, the production of meats for export has become the major industry of Uruguay (Fig. 177). As a result, the country now holds a place second to Argentina as a beef-exporting territory and owns 9,000,000 head of cattle (1929). In 1926 more than 350,000,000 pounds of beef went to foreign markets; this provided 12 per cent of total world exports.

Prior to the period of beef production on a large scale, the Uruguayan industry experienced an evolution similar in practically all respects to that of Argentina. For almost three centuries, the cattle roamed at will on the unfenced ranges and were hunted by the *gauchos*. The sole commercial products were hides and tallow. Dogs and various scavengers made the only considerable utilization of the carcasses. Distance to available markets precluded extensive development of meat exports, whereas hides, especially, provided comparatively high value and little bulk; in addition they would keep in transit.

The rise of a preserved beef industry derived a stimulus from that of Argentina, so that by 1850 the salting of beef had attained material importance. As a lean animal served the purposes of the *saladero*, or salting establishment, the native cattle proved quite satisfactory. In the early 1900's the various enterprises consumed an annual quota of some 550,000 head and produced a yearly average of 100,000,000 pounds of the rendered meat, or *tasajo*. Most of the export moves to Brazil and Cuba, smaller quantities reaching the poorer populations in the Portuguese possessions of the Atlantic, Portugal itself, Spain, and Porto Rico. At that time some 21 plants handled the industry, all of them situated at Montevideo or on the Uruguay, easily reached by animals on hoof and whence the beef could find ready shipping facilities. These *saladeros* at the same time handled the large production of hides, later relinquishing their control to the factories packing frozen and chilled beef. Developments in foreign cattle production and the trend in Uruguay toward improvement of stock with a view to European markets for higher-priced meats contributed to the eventual decline in the production of *tasajo*. Of the yearly slaughter of some 700,000 cattle, the industry today accounts for only one-tenth. Its loss of importance parallels that of the canning interests which utilize an animal of grade slightly higher than that suitable for

the *saladero*. The meat extract enterprises, which as late as 1900 utilized 100,000 cattle annually, have displayed a further decline in an early industry of substantial importance.

Accounting in general for the decline of *tasajo* and canned meats, the most remarkable feature in the agricultural development of Uruguay has been the transformation of stock for the production of frozen and chilled beef. From a modest beginning of 4,000,000 pounds exported by the *Frigorifica Uruguaya* in 1905, trade experienced a meteoric rise to an export of almost 300,000,000 pounds in 1925.

As yet, frozen beef shipments far exceed those of chilled beef. Though the importation of excellent breeding stock has led to a widespread improvement of the herds, in general the cattle do not dress into choice chilled beef. The occasional droughts may send many animals to the packing plants in poor flesh. At times, drought has proved a great danger. In 1914 600,000 cattle and 5,000,000 sheep died from starvation and decreased resistance to disease, and in 1916 another phenomenally dry period caused the death of 1,500,000 cattle. In addition, the tick hampers all of the northern sections of the country and frequently the locust plague occurs. Moreover, though natural forage has high nutritive value, it is inferior to feed such as that afforded by the vast alfalfa fields of Argentina. The increasing advance of *espartillo* grass and various troublesome weeds may cause a greater use of alfalfa, but at present the valuable forage is unimportant, for (1) native grasses are somewhat richer than those of Argentina, (2) as a rule, pastures do not die down, (3) soil conditions favor alfalfa less, and (4) pressure for high-grade cattle in Uruguay has not been so notable as in Argentina. Oats furnish the more common introduced forage.

That the production of beef in the near future can attain a conspicuously more important rank among world industries seems dubious. The very ease with which pastoral pursuits spread to all portions of the country leads to an early saturation point. Unlike its western neighbor, the country has no large tracts of unutilized lands. On the whole, the grazing lands are well-stocked, in some districts already overgrazed. The decrease in numbers of sheep offers a major potentiality for the rise of cattle, but the flocks of sheep can be displaced only slowly because of the significance of wool, mutton, and skins in foreign trade.

The Sheep Industry.—The physical factors favouring cattle grazing exercised a like influence over the raising of sheep in Uruguay. A similar analogy exists between the early periods in the evolution of the industries with respect to major products. Owing to the lack of markets as well as notable prejudice against its use in domestic diet, mutton held no place in the regard of the stock-raisers. For years, flocks of sheep were driven to brick-kilns, there slaughtered, and their carcasses, stripped of the hide, flung into the furnace to feed the fires. In contrast, its high value, proportionately low weight, and keeping properties have made wool the leading export commodity of

Fig. 178. On the Road to Market, Southern Uruguay

The rolling well-drained land of southern Uruguay in many ways favors the rearing of high-grade cattle and sheep. (*Courtesy of the Pan-American Union.*)

Uruguay for more than two centuries. This one product supplies almost one-third of the value of Uruguayan exports today, and alone furnishes a per capita trade greater than the entire per capita trade of Bolivia. So profitable does wool prove, that despite the grazing of almost 19,500,000 head (1928), sheep furnish relatively little mutton, either for domestic or foreign consumption (Fig. 178). Indeed, the trend towards breeding of continually finer fleece, based chiefly in the Rambouillet and merino strains, becomes constantly more conspicuous.

True of the sheep lands as well as of cattle ranges, the grazing areas are stocked almost to capacity. Unlike cattle, sheep have registered a marked decline during the past two decades. The decrease resulted from the disastrous droughts of 1914 and 1916, overstocked

ranges, replacement of sheep by cattle in certain areas, selling of low-grade sheep to stock up with better breeds, and the replacement of sheep by crops, especially flax and wheat in southern Uruguay. The encroachment of both beef cattle and crop land denotes the improbability of maintenance of present importance for many years. As yet,

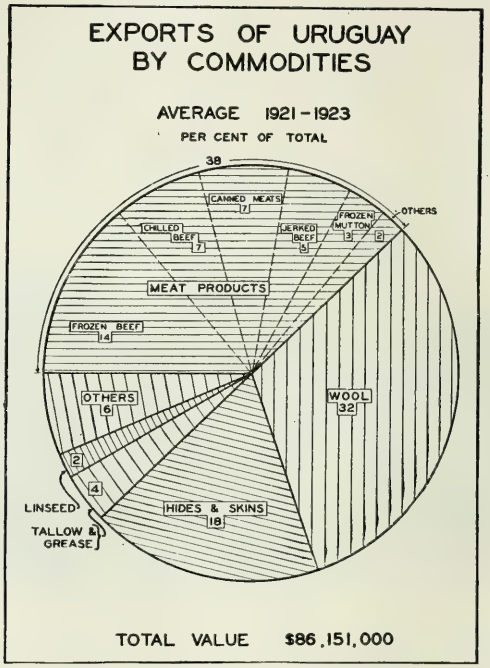

FIG. 179. EXPORTS OF URUGUAY

Until recently animal products contributed as much as 95 per cent of the exports of Uruguay. Farm products, which entered the trade only a few years ago, now constitute 10 per cent of the total (1925). (*From "Commerce of South America," Clarence F. Jones; courtesy of Ginn & Company.*)

however, much progress may be expected, for the improvement of fleeces has far to go to attain its maximum.

Products of the Farm.—Although climate, relief, and soil favor the production of a great variety of crops over much of Uruguay, farming is little developed. The total cultivated area approximates 2,000,000 acres, or slightly more than 4 per cent of the national area. These lands, which engage the labor of only 7 per cent of the population, lie principally in the southern coastal departments and serve to differentiate the La Plata Dairying-Specialized Farming Region from

the northern grazing territory. Hence production has easy access to the markets of Montevideo as well as those of Argentine cities, although in general the yield of the crop lands barely suffices to meet domestic needs. With respect to two products, however, interest has been sufficiently great to initiate a comparatively important export movement. The demand for linseed solely as an export has placed more than 150,000 acres in flax (1928), while wheat, leading crop by area, occupies 860,000 acres and in some years exceeds the export of

Fig. 180. A New Road, Solís to Minas, Uruguay

The improvement of transportation, both rail and highway, will do much to bring fertile soils into greater productivity in several parts of the country. This little country in proportion to population and area spends considerable sums to improve transport facilities. (*Courtesy of the Pan-American Union.*)

linseed. Corn and oats also hold an important place among the crops. Minor products include chiefly potatoes and the several truck crops (Fig. 179).

In the areas producing crops, dairying also has obtained a foothold. The profits secured in the raising of cattle for beef and hides and the lack of domestic markets hamper this branch of mixed farming. Various efforts of the government may cause a marked growth. The sale of milk is the principal dairy enterprise, centered especially in the department of Colonia, where a number of Swiss have fostered the industry, and about Montevideo. Cheese comes in the main from Maldonado, Colonia, Tacuarembó, and Rocha.

Expansion of crop and dairy production has been slow. The *estancieros* with extensive landholdings maintained huge incomes from sheep and cattle without much effort, so that no economic pressure forced them to consider the cultivation of the soil. A sparse population, accustomed rather to the free life in the saddle than to the laborious planting, tilling, and harvesting of crops, further retards an extension of cultivated area. In contrast to the situation in Argentina, no large stream of immigrants entered the country and became

Fig. 181. A Round-up, Southern Uruguay

High-grade cattle on native pasture in southern Uruguay. As in the Pampa of Argentina, the introduction of pure-bred stock into southern Uruguay has revolutionized the animal industry of that part of the republic. (*Courtesy of the Oficina Nacional del Comercio Exterior, República del Uruguay.*)

obliged to break the sod for crops, because the pastoral interests would not make room for them. Moreover, the omnivorous appetite of the locust interposes a hindrance so frequent as to diminish interest in cultivation. Nevertheless, the growth of population, reverses of one kind or another in pastoral activities, and a brisk demand in world markets for cereals and linseed force more and more of the grazing lands under the plow (Fig. 180).

MANUFACTURING

For significant manufacturing developments, Uruguay is peculiarly handicapped. It has practically no coal, petroleum, or minerals for a

basic iron and steel industry; it possesses meager forest resources, little water power, and few other raw materials for large factory establishments. At present, the principal industries consist of meat packing and the preparation of other agricultural products, textile manufactures, and small plants fabricating cement, brick, glass, and furniture. Because of its deficiencies in mineral resources—quarries are the principal mineral industry—a small population and an elementary stage in the development of its agricultural resources, Uruguay can achieve no great distinction as a manufacturing country (Fig. 181).

With but 4 per cent of its area in crops, Uruguay stands upon the threshold of a period of notable progress. The status of pastoral industries, moreover, suggests that the trend towards intensive utilization of the land will become accelerated. While cattle and sheep long will serve as basic industries, they can expand little; but considerable internal development is certain in continued improvement of stock and in betterment of grazing facilities. In contrast, the increasing importance of the lands of the Paraná basin as sources of agricultural raw-materials presents a cogent reason for the expectation of a rapid spread in tillage of the land. Population is a conditioning factor, but immigration shows a decided tendency to reach large annual totals and can penetrate readily to all sections of the country.

Beyond intensive utilization of the land for agriculture, little can arise in Uruguay. The country bids fair to retain its relative importance among South American lands, but others more favored with respect to undeveloped areas or resources for a well-balanced national economy possess means for a far greater advance.

CHAPTER XXIX

THE UNITED STATES OF BRAZIL

The United States of Brazil, in areal extent, ranking as one of the five great countries of the world, embraces nearly half of the total area of South America. Occupying the central portion of the continent, Brazil borders all the political divisions of South America, except Chile. Its vast extent stretches from 5° 10′ N. latitude on the south slope of Mount Roraima to 33° 45′ S. on the boundary of the Uruguay —a distance of 2,670 miles, a latitudinal extent equal to that from the southern border of Ecuador to Atlanta, Georgia. East and west it reaches for 2,690 miles, from almost the longitude of the Azores to that of New York City. A tremendous sweep of land it is, but 93 per cent of it lies within the tropics.

An empire in area, Brazil harbors one half the people of the continent; the most extensive of all the American family of nations, it is comparatively the least developed. Though Brazil holds second place in the trade of the continent, its commerce amounts to only one-fifth of the total; in per capita trade it stands only third from the bottom of the list of South American republics. Brazil with all its territory, variety of resources, 4,000 miles of coast, a great system of river highways, and four centuries of European contacts, has the largest extent of the least known land of any political division of the New World. Only one-fifth of the territory is in farms and only 3½ per cent under cultivation. Almost one half the country supports a dense forest that shelters a sparse and backward Indian folk. More than half the people, consisting primarily of illiterate Indians, negroes, mestizos and zambos, living under simple conditions, produce little and hardly affect the economic status of the country (Fig. 182). This lack of development, this backwardness, compared to smaller, and in many ways less fortunate, countries, is an outgrowth of the interplay of the many historical and social forces, and the contrasted physical conditions that have brought within one sphere of influence the different portions of the United States of Brazil.

HISTORICAL BACKGROUND AND ECONOMIC EVOLUTION

At the time of the advent of the Portuguese, four great Indian families were spread in scattered and different tribes over the whole of Brazil. In stage of culture they varied from tribes of Botocudos, who had not reached the Stone Age, lived in brush shelters, slept in the ashes of their fires, had promiscuous marriage and had no religion except fear of spirits, to the Arawaks, who had tribal organization,

FIG. 182. MOTHER AND FIVE CHILDREN SUFFERING FROM TRACHOMA

Millions of people in Brazil, suffering from trachoma, malaria and other diseases, constitute an economic drag to the nation. They produce little, buy little from the outside, and can hardly improve their miserable conditions of life with assistance. (*Courtesy of Dr. Hackett and the Rockefeller Foundation.*)

built good canoes, cultivated the soil in beans and manioc, built houses, and made flour, earthen pots and coarse cloth. But in contrast to other parts of South America no tribe in what is now Brazil advanced beyond the struggle to obtain a meagre food supply; they never devised a method of preserving and storing food as did the Incas and other highland Indians. Though in a region of supposedly abundant food, defective nutrition sapped their strength. The vast majority of Indians lived from the fruits of forest and stream. They had not discovered and worked metals as did the highland Indians. Scattered, poorly organized, and in a low state of civilization, they were powerless to resist effectively the Portuguese.

Historical developments and economic advance in Brazil have been marked by the production of a number of different commodities in contrasted portions of the country. During the period of exploration and early settlement—1500 to 1549—the east coast of Brazil from Cape São Roque to south of Santos supplied from the *matta* zone of the rainy coast great quantities of dye-wood—Brazil-wood—the product that gave the country its name. Whole fleets of Portuguese and French came to the coast for this valuable wood, in great demand in Europe. Yielding no gold, silver, or spices, and having no civilized inhabitants, the coast did not attract permanent settlement as soon after discovery as did other portions of the continent under the control of Spain.[1] Adventurous Portuguese preferred to enter the spice trade of the East Indies, where great wealth was almost assured them. The East Indian fleets used the excellent harbors of the coast of Brazil to refit the ships and take on water and food.

During this early period the foundations were laid for the first great industry of Brazil. As early as 1525 sugar was introduced near Pernambuco from Madeira and the Cape Verde Islands; sugar was exported in 1526. It provided the basis for real colonization (Fig. 183). But not until after the middle of the century did it assume significance. Local conditions—coastal and piedmont plains, soils, precipitation, sunshine, and a frontage on the sea—favored its culture. The demand for it was great in Europe. Communication with Portugal was frequent and easy. Thus, here developed the first great tropical sugar-exporting region of the world. The industry soon spread south by Bahia to near Rio de Janeiro and north along the northeast coast.

[1] Though Diego Alvarez in 1509 and John Ramalho in 1511 abandoned ships in the coastal trade and took Indian wives near Bahia and Santos respectively, the first permanent settlement was made at São Vincente by an expedition under Souza in 1532. He introduced fruits, grains, cattle and brought cane from Bahia, where it had been taken some years before. The successful founding of a considerable colony in Brazil attracted attention at home; many noblemen solicited for grants. Consequently, the entire coast of Brazil was partitioned into twelve "captaincies," measuring 50 leagues along the coast and extending indefinitely into the interior; they embraced the coast from the Amazon to the Island of Santa Catharina—the points where the Tordesillas line met the sea. Only six proprietors established colonies—from São Vincente to Cape São Roque. The government of Brazil by these "captaincies" failed because of (1) the great extent of the territories, precluding mutual aid and frequent communications, (2) complete inter-independence, encouraging anarchy, (3) the varied composition of the population, unable to develop their lands, and (4) the activities of the French privateers and freebooters in trade and in establishing posts. Only after the appointment of a strong Governor-General in 1549 did organization and advance grow out of chaos.

Local Indians were killed off or enslaved. Negroes picked up on the Guinea coast were introduced in large numbers. The Portuguese settlements farther south, having limited coastal lands, backed by the escarpment plateau front, did not develop the sugar industry. But on foot and on horseback they scoured the whole plateau country to

FIG. 183. PICKING COFFEE, SÃO PAULO

As sugar provided the basis for the first real colonization and firmly established the Portuguese in South America, coffee today constitutes the chief source of economic strength of the leading part of the country and attracts the chief stream of immigrants to this empire. (*Courtesy of T. Preising.*)

the west for Indians to work on the cane plantations of northeast Brazil. Portugal throve upon the sale of sugar to her less fortunate European neighbors. By 1572 120 plantations produced annually 45,000 tons of sugar; Portuguese goods to the value of 1,000,000 dollars a year were imported. Development continued, even though the home country was dominated by Spain following 1580.[2] The

[2] No other portion of South America has had such a checkered political history and at the same time spilled so little of the blood of its inhabitants. A table of the chief periods of Brazilian history will aid the students materially in analyzing present Brazil:

cities in the sugar districts from Rio de Janeiro to São Roque became rich fashionable centers. Settlements had extended along the north coast as far as Pará by 1616—this north coast developing the cattle industry and sugar under irrigation. But São Paulo and South Brazil were of little import. Yet "Paulistas" advanced across the plateau to almost the foot of the Andes, establishing claim to that great westward extension of Brazil in the Campos. Still, sugar was the backbone of the economic life of the country from shortly after the first permanent settlement to near the close of the seventeenth century.

In their raids for slaves the "Paulistas" in 1690 found the rich gold washings of Sabará, where today stands one of the great mines of the

Historical Periods:

I. 1500 to 1549—Exploration and Early Settlement.
   1. First permanent settlement at São Vincente 1532.
   2. Establishment of "Captaincies" 1534.
   3. Exportation of Brazil-wood—the beginning of sugar cultivation.

II. 1549 to 1808—The Colonial Period.
   1. 1549 to 1580—Period of Governor-Generals; stifling trade restrictions by Portugal; increased cultivation of sugar; hunting of slaves by "Paulistas"; struggles against the French; great importation of negroes.
   2. 1580 to 1640—Dominance of Spain over Portugal; Brazil learned own military power; struggles with the Dutch, who all but conquered Brazil; increased sugar trade; great slave-hunting expeditions.
   3. 1640 to 1808—The expulsion of the Dutch; a century and three quarters of western expansion; the discovery of gold 1693; the discovery of diamonds 1729; growth of strong nationality; exploitation of Brazil by Portugal with renewed vigor; stifling taxes and trade regulations; the first developments in Rio Grande do Sul; decline of sugar.

III. 1808 to 1889—The Portuguese Court in Brazil and the Empire.
   1. 1808 to 1822—Portuguese Court in Brazil; freedom of trade and industry; decline of gold and diamonds; revival of sugar and tobacco; growing spirit of nationality; the Declaration of Independence 1822.
   2. 1822 to 1840—Reign of Dom Pedro I; a period of political unrest; political strife between different factions and conflicts with the Emperor; little advance in industry, trade or agriculture.
   3. 1840 to 1889—Reign of Dom Pedro II; peaceful conditions; beginnings of railway construction; coffee culture, cacao culture, exploitation of rubber, and large immigration; the abolition of slavery, 1888. At the close of the period Brazil had 6,000 miles of railway, half a million immigrants, 14,000,000 people—50 per cent classed as white, 35 per cent as mulatto and 15 per cent as negro; and exports valued at $56,000,000.

IV. 1889—The Republic; an early rapid succession of presidents with political reforms, lacking the serious revolutions that shook other South American republics to their very foundations; the development of strong state powers; the period of great expansion of Modern Brazil; a country finding its place among the family of nations and paving the way for the larger rôle it is destined to play.

world, the Morro Belho.[3] Soon half a dozen other fields were discovered, all yielding gold in abundance by the simplest processes. Large nuggets sent to Portugal, started the first great gold rush of modern times. The movement almost depopulated the sugar districts of the coast and even Portugal itself. Slaves were taken in great numbers to the gold washings. To supply the mines agriculture and stock raising were started on a small scale but suffered for want of hands, as only slaves could be kept on farms by the strictest measures and punishment. Soon Rio de Janeiro became the leading city in activity. The principal gold washings were only three hundred miles to the north. All gold had to be shipped through the government offices at Rio de Janeiro. Soldiers guarded every cross road and searched every merchant and slave. The whole plateau was combed for placer washings. By 1718 an expedition had penetrated 1,500 miles to the west and discovered gold on the plateau where the headwaters of the Madeira and the Paraguay intertwine. This was the beginning of Cuyabá and the state of Matto Grosso.[4]

The animated activity and economic changes ushered in by the discovery of gold were accentuated by the discovery in 1729 of diamonds in the gold washings of Minas Geraes. At once declared crown property, the diamond region of Diamantina was marked off by a *dead* line which none except officials were allowed to cross. The original Diamantina district produced 5,000,000 carats from 1730 to 1770. Adventurers swarmed into the region from all parts of the world. Cities sprang up in the wilderness, dazzling palaces were built and thronged and enormous revenues streamed to the coast. Though the gold and diamonds left Brazil for Portugal in heavy chests and under strong guard, their exploitation profoundly affected Brazil. It ushered in a significant element in the population; it caused the development of greater individuality and independence of the people of this part of Brazil; it broke up complete dependence on sugar [5] and

[3] Though a little gold was found in the plateau of São Paulo and Minas Geraes in the sixteenth century, its presence in large quantities did not become an established fact until 1690. The province of Minas Geraes produced 7,500,000 ounces of gold within the first 50 years; its total output to the present has been nearly 30,000,000 ounces.

[4] In 10 years 1,500,000 ounces of gold came out of these washings. A little later other washings were panned on the Madeira watershed.

[5] Other factors also contributed to the decline of sugar; the competition of sugar from the Spanish and French West Indies, the tightening restrictions placed on the trade by the mother country—trade was lawful only with Portugal and taxes were heavy—and much later to competition with beet sugar.

opened the way for the utilization of the hitherto almost valueless plateau lands. The feverish search for gold led exploring parties up all the large tributaries of the Amazon; as early as 1716 they had reached the headwaters of the Madeira, thus establishing claim to this great basin (Fig. 184). To the astounding energy, fearlessness, and aggressive spirit of the "Paulistas" is due the fact that the two Latin peoples of Spanish and Portuguese speech control nearly equal portions of the continent. In the plateau forests were cleared for

FIG. 184. SÃO LUIZ ON THE ABUNA RIVER

The great Amazonian region was fruitless in the first great advance of the Portuguese into the tropical forest, but later staged a remarkable advance in the exportation of wild rubber. Rubber balls in the foreground, pack mules, shelter, and other equipment for the collection and preparation of rubber for shipment. (*Courtesy of Bjorklund.*)

structural timbers for towns, mines and roads; fertile soils were planted to crops and the cattle industry advanced greatly, fresh meat and *tasajo* being produced in large quantities for the camps, and hides going to Portugal.

These commodities—gold and diamonds from the south, sugar from the northeast, tobacco extensively tilled around Bahia, and hides from all portions—continued the economic basis of life of colonial Brazil. With the decline of the richer placers in the closing years of the eighteenth century, sugar and tobacco for a term held first place. All trade was closely guarded by the home country. But in 1808 when the Court of Portugal was transferred to Brazil, the colony thus

becoming the seat of the Portuguese Empire, the country took on a new lease of life in spite of a decline in some of the commodities.

The transfer of the Portuguese Court to Brazil did away at once with the exploitative trade restrictions which had tied Brazil almost hand and foot for three centuries. At once the five great ports of Brazil were opened to the commerce of all friendly nations. The long-standing restrictions on manufacturing and trade were abolished. The country was opened for the first time to foreigners, scientists, engineers, and scholars; military, naval, and medical colleges were established. Commercial nations sent consuls and salesmen to this virgin territory. Though commercial and economic advance during the early years of the Empire was not striking, the foundation was laid in different parts of the country for the great development of modern Brazil.

MODERN BRAZIL

A number of developments freed the country from complete dependence upon a few commodities as was the case for three centuries. They include: the production of different commodities in contrasted sections, the abolition of slavery (1888) and the establishment of the republic (1889), the improvement of transportation facilities, immigration and the increase of population, changes in other lands that created an active demand for the commodities that Brazil could supply, and the development of manufacturing industries.

In the nineteenth century more than half a dozen new commodities swelled the commerce of Brazil and took the place of some of those that all but fell by the wayside. They include: rubber, cacao, and Brazil nuts from Amazonia; cacao, timbers and tobacco from Bahia; vegetable waxes from Northeast Brazil and Amazonia; coffee, cotton, and meats from the Central Plateau of Eastern Brazil; and Paraná pine, *yerba maté,* and animal products, especially meats and wool from South Brazil.

Some of these lines of development well under way received a serious check with the abolition of slavery in 1888 and the political uncertainties consequent upon the establishment of the republic in 1889. Though by 1888 as many free colored men lived in Brazil as slaves, the emancipation at that time necessitated a complete change in the economic structure of some industries. This was especially

true in the sugar, tobacco and cotton regions of the Northeast. The overthrow of Dom Pedro II, who ruled as Emperor from 1831 to 1889 and who did much to advance Brazil by employing sound political and economic policies, brought dark days to the young overgrown republic, with a quick succession of poorly equipped presidents, the incurring of a heavy national debt, and the development of a decentralized republican form of government.

Though the first railway line in Brazil was opened to traffic shortly after the middle of the nineteenth century, railway construction continued slowly, owing to political manipulation of laws, rates and taxes, and to difficult topography of the plateau front to be scaled by all lines from the seacoast to the interior. In 1875 the country had less than 1,000 miles in operation. Today the republic has only 19,000 miles of railway, but they provide a network of lines for the Central Plateau of Eastern Brazil and connect many producing districts with ocean ports. Yet the railways have only touched the fringe of this vast republic. In the recent opening up of new lands, railways have preceded population in large numbers. The dominance of the eastern fringe of Brazil in the economic life of the country is due in no small measure to the transportation facilities it possesses.

While European immigrants have not flocked to Brazil as they have to the United States of America and Argentina, they have completely transformed the landscape and industry of considerable areas in the Central Plateau of Eastern Brazil and in South Brazil [6] (Fig. 185). During the first hundred years of independence, Brazil received only 3,650,000 European immigrants; in the same time the United States received 33,500,000, more coming to the United States in the three years commencing in 1905 than Brazil got in 100 years. Of great significance to Brazil is the fact that nearly two-thirds of all immigrants coming to the country during this time were south Europeans, blood brothers of the Portuguese, who learned the language easily and blended with the Brazilian population almost completely during the first generation, and less than ten per cent were north Europeans who tend to separate themselves and retard or prohibit assimilation. In recent years immigration has averaged nearly

[6] Few immigrants came before 1850, when the importation of slaves was practically stopped by the Brazilian Government. From 1821 to 1850 1,500,000 slaves were brought from Africa to Brazil.

100,000 Europeans. Brazil has not had the flood of immigrants like that flowing into Argentina but its population has increased faster. In 1808 the population was about 3,000,000—one-third negro slaves, one-third free negroes and mulattoes, and one-fourth whites. Today the population of 39,000,000 (estimate) is half that of all South America.

As in Argentina, developments outside of Brazil created an increasing demand for Brazilian products. Several inventions making possible the use of rubber in rain coats, bicycle tires, buggy tires, electrical supplies and later automobile tires, brought increased flow

FIG. 185. SANTA CATHARINA, NEAR UNION DA VICTORY

German colonists in the pioneer country of South Brazil, clearing the forests, planting patches of subsistence crops and establishing homes; in the distance the even sky line of the basalt plateau stands out. (*Courtesy of C. F. Marbut.*)

of sap from the rubber trees of Amazonia. The greater consumption of chocolate and candies stimulated the output of cacao beans of Amazonia and Bahia. The coffee blight in Ceylon and the mounting consumption of coffee in the northern hemisphere caused enormous plantings of coffee trees on the rolling lands of the plateau of São Paulo and Minas Geraes. The peopling of the Pampa and the prairies of Rio Grande do Sul and Uruguay called for the structural timbers of the Paraná pine region of South Brazil. The World War, in cutting off the supply of goods, stimulated manufacturing in Brazil and brought about a greater production of cotton, sugar, hides and timbers for supplying domestic needs. Moreover, the decline of beef exports of the United States and the slowing up of the movement from Argentina has brought packing plants to South Brazil and has

opened the way for a more efficient utilization of the pastures of the region.

In recent years a significant development has been in manufacturing industries—in cotton textiles, silks, leather goods, tobacco products, sugar, furniture and structural materials. Factors in this advance include the receipt of a large number of skilled laborers from Europe, the expanding market at home as a result of increased population and greater purchasing power, abundance of raw materials, political conditions attractive to foreign capital, the development of hydro-electric power, and protective tariffs. In spite of these various lines of advance, Brazil does not have an all-round development as a country as a whole. Like Argentina, though not quite to the same extent, its exports consist chiefly of agricultural products with only 3½ per cent of the land under cultivation, and its imports chiefly of manufactured wares.

The various regions and their peoples, comprising the republic, have developed different economies. Accentuating regional interests at the expense of national unity are the lack of transportation facilities to serve as a bond of union, widespread illiteracy, the lack of knowledge of one region by the people of the other sections, contrasted types of population, an outlook to the sea in different directions, and a great expanse of territory.

Though not favoring unity in a strong sense, these different regions, in their varied resources, provide the bases for a great nation since they may produce complementary products. The republic, only 30 years old, with half the area and half the population of South America, possesses, perhaps, more undeveloped resources and larger areas of untenanted land than any other country of the world. The deep forests of Amazonia, except for rubber, remain almost untouched; the vast pastures of the Campos lie chiefly ungrazed; the fertile soils of much of the great plateau have not felt the cutting edge of a plow. And enormous iron beds, other mineral deposits, and the immense hydro-electric sites of the old Archean shield of the Central Plateau of Eastern Brazil and South Brazil lie dormant as they have lain in the long ages past.

In the face of the progress Brazil has made and this striking combination of resources, a number of conditions hinder an early realization of the full possibilities of the country's wealth. Though it has

half the population of South America, Brazil needs people—a strong, sturdy people, like the better class of European immigrant—to bridge the gap between the illiterate, inert mass of lower classes including a majority of the population, and the rather spiritless, extravagant aristocracy of planters and plutocracy of business men and financiers. To march forward rapidly, Brazil must elevate human standards by

FIG. 186. PRIMITIVE AND MODERN TRANSPORTATION

On the rolling surface of the Central Plateau of Eastern Brazil modern roads, electric and steam railways are bringing vast areas into productivity; Lavras, Minas Geraes; the kapok-silk cotton tree in the center. (*Courtesy of Ernest G. Holt.*)

education, sanitation, and selective immigration, and prepare the way for the hundreds of thousands of European immigrants now seeking entrance to this southern continent.

Brazil suffers from inadequate transportation facilities (Fig. 186). The country has only 19,000 miles of railways. Railways have touched only the fringe of eastern Brazil, and in this area three different gauges exist, making practically impossible the development of a uniform system. Potential crop lands of the South and pastures of the Central Plateau and of the great Campos cannot be brought into

productivity until means of shipping the fruits of the farm and the range have been provided.

For a full realization of the advantages conferred upon it by nature, Brazil wants less political manipulation of prices and stocks of the leading export commodities and less interference with the currents of commerce. Excessive export duties imposed by individual states and municipalities have brought ruin to some of the great enterprises of the country.

If Brazil can meet the three major needs of a virile population, transportation facilities, and a stable government with economically sound trade policies, each major region of the country—South Brazil, the Central Plateau of Eastern Brazil, the Rainy Coast of Bahia, Northeast Brazil, the Campos and Amazonia—will contribute its bit in making this vast empire the industrial and commercial master of the southern hemisphere.

CHAPTER XXX

SOUTH BRAZIL

Though the three southern states of Brazil—Rio Grande do Sul, Santa Catharina, Paraná—provide only a small part of the country's foreign trade, in actual importance among the regions of South America they rank high and in potential resources they face a future of great development. The variety of these resources is a salient feature of the area, a condition largely due to its character as a transition zone between the tropical and subtropical sections of eastern Brazil and the temperate lands of the southern Paraná basin. For South Brazil as a whole, the distinguishing element is that of temperateness, in contrast to the remainder of the country—temperateness in many ways.

Despite its attractiveness for settlement, the land only in recent years has achieved any particular prominence in Brazil. More than one-third of its area of 225,000 square miles has a density of population of less than 10 persons per square mile. The total population of the region, some 4,000,000, only slightly exceeds that of tropical Bahia. Early Brazil was tropical Pernambuco and Bahia. This retardation in time of settlement has clearly differentiated the population of South Brazil from that of the remainder of the country. Whereas in the north, the Portuguese colonists settled in relatively large numbers, intermingled with the Indian, and later brought the negro to add another element to the group, in the south live comparatively few of Portuguese descent, and practically no negroes, the white population consisting principally of Germans, Italians, and Poles. Moreover, these late arrivals found no population already controlling the agricultural land and consequently were able to obtain farms individually by clearing the forests. The livestock industry of southwestern Rio Grande do Sul, which antedated settlement of the east by a century, interfered little with this process. In 1824, São Leopoldo in northeastern Rio Grande do Sul was established by the Germans. Though growth in population proceeded slowly, the

German colonist settled in many parts of the region; he and his descendants compose a large part of the total peopling. Late in the nineteenth century came Italian immigration, a second important element, principally to the north and west of the German settlements in Rio Grande do Sul. Both peoples took up land in Santa Catharina also, but Paraná has acquired a predominantly Polish settling.

The cities which these racial groups have developed bear considerable evidence of their mode of origin. Porto Alegre, the largest center in South Brazil, has 200,000 people, of whom more than one-quarter are of German descent. This city, capital of the state of Rio Grande do Sul, lies in a productive area on the Guahyba River about 10 miles from the northern extremity of the Lagõa dos Patos. Several navigable streams reaching the Lagõa near the city give Porto Alegre considerable commercial importance, although large ocean steamers do not reach the port. For the ocean shipping, the excellent harbor of the city of Rio Grande do Sul affords the only facilities in that state, while Pelotas, a short distance to the west in a rich agricultural district, and with provisions for coast-wise steamers, has grown to second rank among cities of the state with 82,500 people. In Santa Catharina, the primitive state of development as yet has not given rise to any large cities. With some 40,000, Florianopolis, on an island off the coast, has the major concentration. Paraná has its principal town in Curityba, on the plateau, with a population of 78,000 largely of German descent. Paranaguá and Antonina, small ports, ship the *yerba maté*, lumber, and coffee which Curityba handles.

Proximity to the sea has been a potent factor in locating the principal cities near the coast. In the interior, the trunk railway from São Paulo to Montevideo has developed a number of smaller centers and also enhances the value of the coastal towns by its four principal transverse branches. On the west, though the Uruguay River is a considerable one, its several rapids destroy most of its present utility for the region.

PHYSICAL SETTING

In many respects, the land surface of South Brazil resembles that of the Central Plateau of Eastern Brazil. Rolling plateau makes up almost the entire area of the region, though here elevations are lower. In general, however, it is the same type of rolling upland, well-drained,

and forest-covered in large part, with major slope and drainage towards the west (Fig. 187). A long, narrow, coastal plain borders most of the region and from the plain the land rises in some places abruptly and in others more gently to an average height of 2,000 feet in the Serra do Mar, although peaks exceed 5,000 feet. One great difference distinguishes South Brazil from the region to the north, one which restricts to a certain extent development in the former, and that is the comparatively great extent of sandstone plateaus. Although here

FIG. 187. THE ROLLING PLATEAU OF SOUTH BRAZIL

The north edge of the Paraná Plateau, 15 miles south of Union da Victory. Rolling, well-drained and humid, much of the northern portion of South Brazil consists of timbered land; homes of German colonists in a pioneer land. (*Courtesy of C. F. Marbut.*)

too basalts have given the region its best agricultural lands, their proportional area is far less than that in the state of São Paulo for example (Fig. 188).

Climate for most of the region is quite healthful. Latitude causes high summer temperatures, especially on the eastern lowland, but the considerable amplitude of daily temperatures gives the plateau relatively cool nights; snow is not infrequent even on the heights of Santa Catharina. In contrast to adjacent lands, the region receives a notably uniform seasonal allotment of precipitation. In each quarter of the year, much of the land receives between 14 and 20 inches, with a slight maximum in the warm season, except on the

coast, where this maximum is pronounced. For the whole year, almost all of the region records more than 60 inches, the southeast and southwest receiving smaller amounts as reflected in their leading industries.

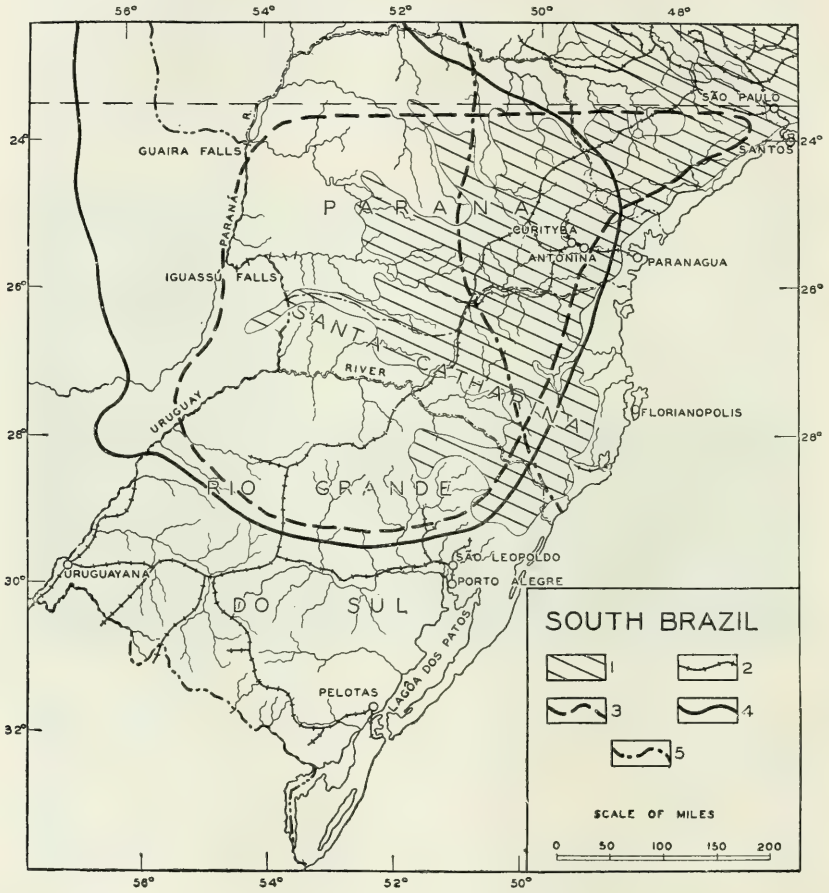

Fig. 188. Map of South Brazil

South Brazil consists of rolling, relatively well-drained, plateau lands, transition land between tropical and temperate regions; (1) the highland portions of South Brazil, (2) railways, (3) the border of Paraná pine, (4) the border of *yerba maté* production, and (5) the southwest border of coffee culture.

Though amount and distribution of precipitation are similar for most of the region, conditions of soils and temperatures explain in large part notable differences in plant life. South Brazil has dense tropical rain forest in the northeast, more open stands of pine in the

northwest, and savanna in the south. Growing over a small part of the region, the tropical hard woods occupy chiefly the eastern slopes of the Serra do Mar. The species in general correspond to those of the same forest in São Paulo and Rio de Janeiro. The major forest wealth of South Brazil lies in the stands of Paraná pine (*Araucaria brasiliana*) which grow in parts of all three states, but principally in western Paraná and Santa Catharina. The exploitation of the forest riches is among the leading industries of all the states. In all parts of the forest, the *yerba maté*, here called *herva matte*, also constitutes the basis for an important industry. The zone of Paraná pine grades southward into the savanna and finally into open grasslands of southern Rio Grande do Sul, resulting in a grazing area deriving great benefits from the dependability of the growth of grasses and a district in most respects like the pastoral territory of Uruguay.

OCCUPATIONS

Owing to the diversity of vegetation principally and soils secondarily, South Brazil has devoted itself to three major types of exploitation. In the southwest the grasses of Rio Grande do Sul support the most important livestock industry of Brazil. The east, because of forest wealth, fertility of soils, and conditions of transportation, has become a productive area of general farming. The utilization of the valuable growths of Paraná pine and *yerba maté*, primarily in the northwest, has given rise to two of the leading forest industries of South America.

Pastoral Industries.—At present, the major products of South Brazil come from the livestock industries, notably that of cattle-raising. Not only does the region have the principal districts of livestock in the country, but parts of it promise greatest development. Almost totally in southwestern Rio Grande do Sul, the 10,000,000 cattle of the region total 30 per cent of all those in Brazil. The sheep of the same area compose almost three-fourths of the total for Brazil, while swine, which are produced largely to the east in the German colonies, constitute 30 per cent of the country's holdings.

Cattle.—The cattle industry has become quite distinct from other occupations in the region. The grasslands of Rio Grande do Sul support little besides cattle and sheep, an outgrowth both of transportation conditions and of population elements. Owing to distance

from the sea, cattle and sheep proved the easiest and best method of utilizing the grazing lands. Moreover, the *gaucho* of Portuguese descent had no desire to till the land. The suitability of a climate permitting year-round open grazing on comparatively good grasses gave the industry an early start from which it has grown to considerable proportions. Hindrances to healthy growth lie in the prevalence of hoof and mouth disease, the tick, the berne fly, and low-grade stock.

Long the chief product, *xarque*, or dried beef, is being replaced by chilled and frozen beef. However, the keeping qualities of *xarque*, together with its great quantity of nourishment per unit of weight, make it highly suitable for large parts of Brazil, and the size of the domestic market affords the production of this beef a substantial basis. The home market will continue to require enormous quantities of dried beef made from lean animals.

The precedents set by the advancing cattle-lands of Argentina and Uruguay have contributed to improvements in South Brazil also. From a beginning in the early years of the World War, exports of frozen beef have reached large totals. Large packing plants, foreign-owned, operate at Rio Grande do Sul and Pelotas, near steamship facilities, and at Santa Anna do Livramento in the heart of the cattle-lands, whence the products reach the sea by way of Uruguayan railroads to Montevideo.[1]

In addition to furnishing *xarque* and frozen beef, the cattle of South Brazil serve in many ways. The herds yield a number of the usual by-products and their hides are of much importance in international commerce. Moreover, for the non-pastoral sections of the region especially, cattle are the ordinary draft animals.

Sheep.—Sheep find a far less favorable habitat in the region than cattle. Nevertheless the possibilities of meeting regional requirements for wool have maintained a growing industry; the use of mutton has practically no vogue in the whole area. Almost wholly confined to the southernmost state, sheep total almost 6,000,000. The high temperatures prevent the yield of a high-grade fleece, but a constant importation of foreign blood has sustained the quality. Growing local demand for wool encourages the growth of the industry.

[1] The two regions of large beef production for foreign trade in Brazil include Rio Grande do Sul, which slaughters about one-third of the cattle going to packing plants, and São Paulo, which kills nearly two-thirds; in 1928 Brazil exported nearly 150,000,000 pounds of beef, one-half of which consisted of chilled and slightly frozen beef.

FIG. 189. DISTRIBUTION OF SWINE IN SOUTH AMERICA

Swine are raised in every state of Brazil but the regions of large numbers correspond to those of denser population and a large yield of corn; compare Fig. 197; Brazil has more swine than the remainder of the continent.

FIG. 190. DISTRIBUTION OF CORN ACREAGE IN SOUTH AMERICA

As an important food and feed for man and beast corn is grown in most sections of South America but is concentrated in the eastern and southern parts of the continent; in South Brazil it occupies a more important place among the crops than it does anywhere in the country, with the possible exception of small patches in Amazonia

Swine.—The foraging capabilities of swine give these animals a significant place in the systems of farming common to the general farming lands of the east. Adapted to pioneer conditions, the animals find abundant food. Many root for themselves in the forests and woodlots; some are fattened on corn. They provide a cheap food supply that can be prepared and kept by the small farmer. In the

FIG. 191. THE DISTRIBUTION OF BEAN ACREAGE IN BRAZIL

(Statistics for all the Brazilian Maps were compiled from *Recenseamento do Brazil*, Vol. III (*1a parte*), pp. 289–425 and (*2a parte*) pp. 246–335, *Agricultura, Ministerio da Agricultura, Industria, e Commercio, Directoria Geral de Estatistica*, Rio de Janeiro, 1925.)

zones outside of pastoral Rio Grande do Sul swine outnumber cattle one and one-half times. Although the animals consist of a poor type, thin, large-boned, and difficult to fatten, they suffer less from parasites and diseases than in the more tropical parts of the republic. Allowed a free range in the woods, they are rounded up at intervals for butchering. Breeding is a matter of chance; no selection of stock is made (Fig. 189).

Crops.—The production of crops is confined mainly to the eastern margin of the plateau, where nearly every farm grows a variety of

foodstuffs in a frontier-like fashion, utilizing little machinery and employing crude farming methods. Much of the land recently cleared for cultivation is full of stumps and dead trees. Of the land in agricultural holdings more than half is in pasture or woodlots and in general the entire farm averages small.

Corn, the leading crop in the area, fits in well with natural and economic conditions (Fig. 190). It is a fairly productive crop, even with poor methods of tillage; much of it may be planted

Fig. 192. Cassava Acreage, Brazil

Cassava, beans and corn, staple foods of the tropics, show similar areas of concentrations in Brazil; in acreage devoted to their cultivation, corn outranks the others by far. Cassava, for the most part, is grown in relatively small patches and receives little care.

among girdled trees or standing stumps and give good yields with little care after planting. It may be used in a variety of ways as food for man and as feed for beasts. The heavy rainfall, fertile red soils, and high temperatures insure a good growth, but the lack of a distinct dry harvest period causes a soft corn that must be dried in the sun on open earthen or cement floors. Consequently, little or no corn is exported; it will not ship well.

Beans, the second crop in the region from the standpoint of area, are produced especially in two districts, northern Rio Grande do Sul and eastern Paraná (Fig. 191). While a variety is grown, the common bean is a black type. In a few places beans are planted alone as the

only crop, but most of them grow with corn. Most varieties consist of climbers or pole beans.

The cassava tuber, a staple food of the hot parts of Brazil, is grown in large quantities in this region (Fig. 192). Two principal kinds are

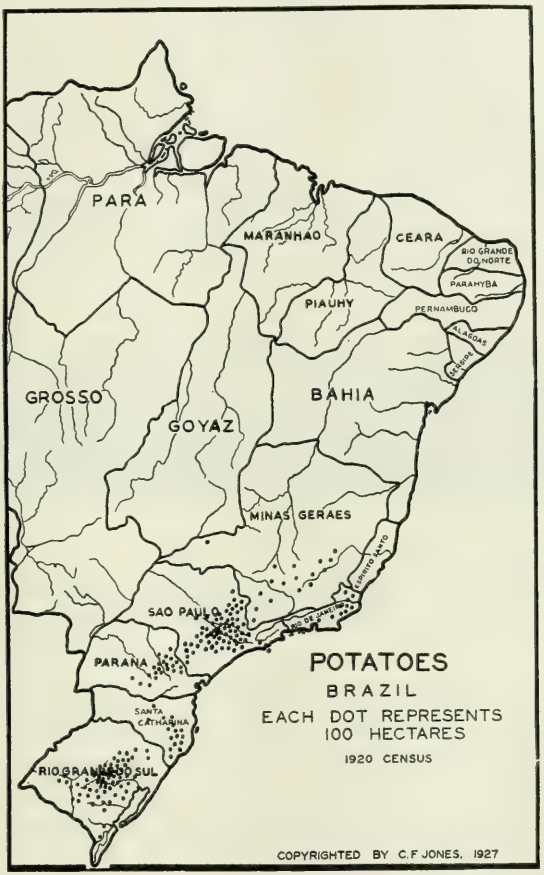

FIG. 193. POTATO ACREAGE, BRAZIL

The Irish potato, the mainstay of many folk in the Andean countries, holds a minor place in Brazil. Its cultivation in this country is confined chiefly to the southern part; moist conditions and high temperatures of more tropical portions do not favor its culture.

produced, a poisonous kind and a non-poisonous kind; the former is used for making flour (*farina*) and starch; the latter for food and feed and also to a small extent for starch. The plant grows up to 3,000 feet elevation and seems to do best on light friable soils. The roots

mature in 8 to 24 months; the commercial crop, for tapioca, grows for 2 years. Cassava yields large crops with little attention.

Rice, sugar, wheat, and Irish potatoes are all local supply crops. They occupy a significant place in the diet of the people. Both lowland and upland rice are cultivated by small farmers in the region; but low temperatures and an uncertain supply of water restrict rice culture. Crude methods of production prevail; yields per acre are low. Planting takes place from August to December and the harvest from January to June.

Nearly all of Brazil's wheat grows in the state of Rio Grande do Sul, as rusts and fungus diseases preclude its production in the hot, moist regions farther north; even here conditions are far from ideal. As a result of climatic conditions, only soft wheats are produced. Yet this region supplies about one-third of the nation's requirements. Wheat culture is expanding with national and state aid in producing new varieties of wheat more suited to moist, hot conditions and in combating insect pests and diseases. But poor agricultural methods, inadequate transportation facilities, and competition with cheaper wheats from temperate regions greatly retard wheat culture.

Potatoes, owing to their large productivity per acre, are more important than the areal comparison with other crops would indicate (Fig. 193). The potato is confined chiefly to the highland portions of the region where cool temperatures prevail at the time the tubers are forming. Potato diseases, resulting from high temperatures and moist conditions, restrict their cultivation. Like other crops in the region, potatoes receive little attention after planting.

Forest Industries.—Exploitation of resources in Paraná pine and *yerba maté* gives Paraná and Santa Catharina their leading industries, and in eastern Rio Grande do Sul also the forests provide numerous advantages for settlement. This region in the Paraná pine holds the largest stand of commercial softwood timber in South America. The pure stands of the Paraná pine afford a timber reserve of 860,000,000,000 board feet, of which at least 300,000,000,000 feet are suitable for high-grade commercial purposes.

The Paraná pine, a tall, straight tree with a wide flattened crown, attains a diameter at maturity of 2 to 7 feet and a height of 80 to 130 feet. Mature trees have long, clean boles with little taper except in

the crown log, which also has most of the branches. It gives a yellow, soft, flexible, elastic, and easily worked wood. But it warps and splits readily unless well seasoned. It is used in a variety of ways, but decays rapidly in contact with the ground.

Although of recent development, the Paraná pine industry has expanded rapidly in recent years owing to the lack of other soft lumber and structural timber in this part of the continent. The annual cut now amounts to about 130,000,000 board feet. About two-thirds of the output is consumed in Brazil, the other in Argentina and Uruguay. Few mills are large modern plants with the equipment needed for the manufacture of all kinds of lumber (Fig. 194). Most of them lie near the great trunk railway extending from north to south across

Fig. 194. Paraná Pine

A modern sawmill in the Paraná pine region of Santa Catharina. The long, straight branch-free trunk of this tree supplies the chief source of softwood lumber in South America; the region can supply Brazil, Uruguay, and possibly Argentina. (*Courtesy of La Razon and the Pan-American Union.*)

the region. In general, lumbering, milling methods, and the curing of lumber are crude. Some vast landholdings exist, and many range in size from 1,000 to 30,000 acres.

While the industry faces handicaps in poor transport facilities (the logs when green will not float), inadequate equipment, poor methods of lumbering, milling, and curing, and lack of labor, it may expand considerably, for these disadvantages may be overcome. With large stands of excellent timber, it is expected that the industry will expand, in the near future, to the point of supplying most of the lumber products of South Brazil, Uruguay, and Argentina.

Though the lumber resources hold great promise, at present they are far overshadowed by the importance of *yerba maté* in both Paraná and Santa Catharina. An extension of the *yerba maté* lands lying in Paraguay and Misiones, these producing areas have undergone great

development in recent years.[2] Domestic requirements are huge and as much as 200,000,000 pounds annually go to Argentina, Uruguay, Paraguay, and Chile. The preparation of the leaf is the basis of the leading manufacturing industries of Curityba; the state of Paraná secures most of its revenue through the export taxes on this single commodity (Fig. 195).

Manufacturing.—South Brazil as yet has developed comparatively little industrial activity. Population is small and resources for basic

Fig. 195. Transporting Yerba Maté Leaves

What coffee is to São Paulo, *yerba maté* is to Paraná and to a small degree to Santa Catharina; the country folk in South Brazil, Paraguay, Uruguay and north Argentina every afternoon sip *maté* and discuss the happenings of the day; the crushed *maté* leaves are placed in a small *gourd-bombilla* and a tube inserted; hot water poured into the gourd is sipped through the tube, the same gourd and tube making the rounds as long as any one cares for *maté*. (*Courtesy of the Pan-American Union.*)

manufactures meagre. Though eastern Rio Grande do Sul has the most important copper mines in Brazil, the deposits have little significance. Of far greater present interest is the coal produced near Porto Alegre. The mines of this district produce most of Brazilian coal and despite its low grade contribute materially to the importance of Porto Alegre. For the future, an even greater basis for industry lies in the enormous possibilities of hydro-electric power in the many rivers of the region. The principal existing industries depend closely

[2] See the chapters on Paraguay and Mesopotamia for the physical requirements of the plant, the details of the industry and the producing districts.

upon the leading activities of the various parts of the region—meat-packing, preparation of *yerba maté*, and milling of timber, in addition to the usual manufactures of small urban areas of farm equipment, leather goods and furniture. Its cattle and the cities of Porto Alegre, Pelotas, and Rio Grande do Sul, have raised the state of Rio Grande do Sul to third place among the states of Brazil as a manufacturing area.

THE FUTURE

That South Brazil will continue a progressive development seems assured. The climate is healthful, the soils fertile in large areas, forest resources huge, water power reserves great, and transportation facilities considerably less a problem than in most of Brazil. Furthermore, the composition of population indicates the rise of a class of people fostering the best interests of the region.

The pastoral industries already are in the process of transformation which will bring the grazing land of Rio Grande do Sul before the world as a vital source of meats. With the Pampa reaching a peak in its beef exports, the salubrious savanna lands of South Brazil are destined to undergo marked development in its cattle industry. The exploitation of Paraná pine on an important scale has scarcely begun; the forests constitute a source of enormous wealth. In contrast, the rapid growth of plantations of *yerba maté* in Argentina and Uruguay may reduce the power of the Brazilian industry, but always there exists the large domestic market. In all parts of the forest, clearing will bring new lands into agricultural production. With these varied bases for advance, South Brazil shows every indication of strengthening its rank as the natural area in the country second in importance to the Central Plateau of Eastern Brazil.

CHAPTER XXXI

THE CENTRAL PLATEAU OF EASTERN BRAZIL[1]

As a natural region, the Central Plateau of Eastern Brazil has greater capability for a highly important, independent economy than any other portion of South America. Middle Chile may have a greater variety of resources, but they sink into insignificance when compared with the enormous proportions of natural wealth in these Brazilian lands. Without the productive lands of São Paulo, Minas Geraes, Rio de Janeiro, Espirito Santo, and Goyaz, Brazil lies a mere husk. The Central Plateau of Eastern Brazil is the heart of the country. Here are combined exceptionally fertile soils and a rolling plateau surface, producing among others the most valuable single export crop in South American trade. For a large part of the region, the climate has been described as among the most pleasant in the world; the coastal margins, however, are hot, humid and poor places for man's comfort. Resources in forests, as well as grazing lands, are considerable. Mineral wealth lies in huge stores almost untouched. Though the area lacks coal, a colossal development of water-power is certain.

On this physical sub-structure has grown the most populous region of South America, the population of 16,000,000 exceeding that of all Argentina by almost 50 per cent. Its boundaries inclose the largest area on the continent, having a density of population greater than 30 persons to the square mile. The history of this growth is a checkered one. Like all the lands of Brazil not essentially tropical, the region lay practically untouched during the heyday of the eastern lowlands, although the Portuguese early came to the plateau. The first arrivals set the foundations for the city of São Paulo by undertaking an active traffic in Indian slaves. Their forays into various districts led to the mining developments of Minas Geraes and Goyaz as well as farther west about Cuyabá. These discoveries caused the

[1] With the Central Plateau proper have been grouped the contiguous portions of the Serra do Mar and the adjacent coastal districts.

primary important peopling of parts of the region; by 1775, Minas Geraes had a mixed population of 400,000, and Rio de Janeiro, with 50,000 souls, had surpassed Bahia as the chief city of the colonies. The gradual restriction of possibilities in gold and diamonds gave the livestock industries pre-eminence, and as a grazing country most of the region carried on its activities until well into the nineteenth cen-

FIG. 196. PICKING COFFEE, FAZENDA BÕA VISTA, SÃO PAULO

A stream of high-grade Italian immigrants has supplied the bulk of the labor for clearing the land, planting the coffee trees, caring for tilled crops between the rows of coffee, picking the crops and distributing the coffee; these and other immigrants have laid the foundations for the expansion of the Central Plateau of Eastern Brazil along many lines. (*Courtesy of R. Preising.*)

tury. In the rich coastal lands, sugar, cotton, and corn supported an important agricultural life; southern Goyaz supplied quantities of provisions for the mines. Coffee, in an important way after 1880, introduced a profound shift in the alignment of industries. The plateau came into its own as the wealthiest portion of Brazil. Cultural requirements for the new crop demanded huge supplies of labor, and European immigrants, under stimulus of various governmental sub-

ventions, flocked to the region; chiefly Italians, they totalled more than a million in the years 1887 to 1902 (Fig. 196). Thereafter growth continued apace. The state of São Paulo, which had a population of 2,250,000 in 1900, had nearly 5,500,000 in 1928; in the latter year Minas Geraes had 6,500,000 people. For most of the area, population is distributed with notable uniformity. Aside from Rio de Janeiro, São Paulo, and Santos, there are few large towns. With all of its 220,000 square miles and 6,500,000 people, Minas Geraes has no town larger than Juiz de Fora with 118,000 souls.

The city of São Paulo well illustrates the rapid increase in population, for from a population of 64,000 in 1890 it has grown to a great metropolis of 1,000,000 people, the third largest city of South America and the leading industrial center of the continent. Virtually all of this the city owes to coffee, although the commanding site relative to access to the coast has been of importance in strengthening its power. A hustling, bustling center, "the Chicago of South America," it is the most rapidly growing large city of Latin America. Its port, Santos, with which it is linked by a single railway over the Serra do Mar, handles 53 per cent of the exports and 39 per cent of the imports of Brazil, a trade which has given rise to a population of more than 100,000 in this town which exists solely in the rôle of a port.

Rio de Janeiro depends less upon the products of the region for its growth, but its wonderful harbor and its access to a huge hinterland, aside from its part as the capital of Brazil, account for its steadily growing population. While increasing less rapidly and with fewer prospects for tremendous development than São Paulo, owing to conditions of tributary territory, site, and the climate of the low coast, Rio de Janeiro is far larger than the plateau city. Its more than 1,000,000 people depend chiefly on the concentration of facilities for importation, manufacture, and distribution which has arisen in partial consequence of its administrative functions.

Both of these principal cities of Brazil as well as their productive hinterlands owe a large part of their growth to the railroads of the region. Though the Serra do Mar interposes a notable barrier between plateau and coast, it also has several breaches advantageously located with respect to ports, particularly in the case of Rio de Janeiro. On the plateau, the great agricultural production has caused

the development of a rail system, in extent surpassed in South America only by the Pampa. As in the Pampa, however, the multiplicity of gauges has hampered development to a certain extent. The rivers which drain the region contribute little to transportation, for with few exceptions they flow westward or northward. Their major usefulness lies in the future development of a mighty store of hydro-electric power.

PHYSICAL CONDITIONS

The rolling plateau surface averages some 3,000 feet in elevation with the greatest height in the east and is reflected in the localization of the principal crops. Interruptions to the broadly undulating surface of the coffee areas are few (Fig. 197). In the south, the Serra da Mantiqueira rises boldly above adjacent areas, as suggested by the distribution of cultivated land; at the north, several ranges contribute to the greater relief of Minas Geraes. The well-drained and healthful upland favors agriculture and an energetic population. In contrast, the low, generally unhealthful, coastal areas support only ports handling plateau commodities or import trade and produce two important crops—sugar and bananas.

The crystalline and certain associated areas which compose large parts of Minas Geraes and Goyaz hold enormous mineral wealth. Their gold and diamonds led to the early development of much of the interior. This early exploitation is well indicated in the name of the principal mining state of the country, Minas Geraes (*Minas generalisados*), and of certain of its cities, Diamantina and Ouro Preto (black gold). Huge reserves of rich iron and important deposits of manganese and mica swell the list of minerals.

Variety of elevations, climates, and rocks has produced several important soils, ranging from the rich and originally forested *terra rossa,* pre-eminently the coffee soils, to somewhat infertile soils supporting only the *campos* vegetation; the latter are developed in the sandstone and shale areas of the São Paulo plateau. The eastern coffee districts utilize a third group of soils—heavy reddish clays, granitic and gneissic in origin, and quite inferior to the *terra rossa.* Those western coffee lands located on diabasic and other areas of igneous materials have great fertility; they show abundant potash and have constituted the basis for the rapid growth of Brazil's coffee

industry. In general the location of such soils is indicated either by more productive coffee plantations or heavier tree growth.

In addition to the well-drained healthful upland, with its extensive areas of fertile soils, most of the region has a notably favorable climate. Over the generally heavily forested narrow strip of coastal lowlands and the seaward slopes of the plateau margin there is an annual rainfall as much as 80 inches in comparison with that of 50 to 60 inches

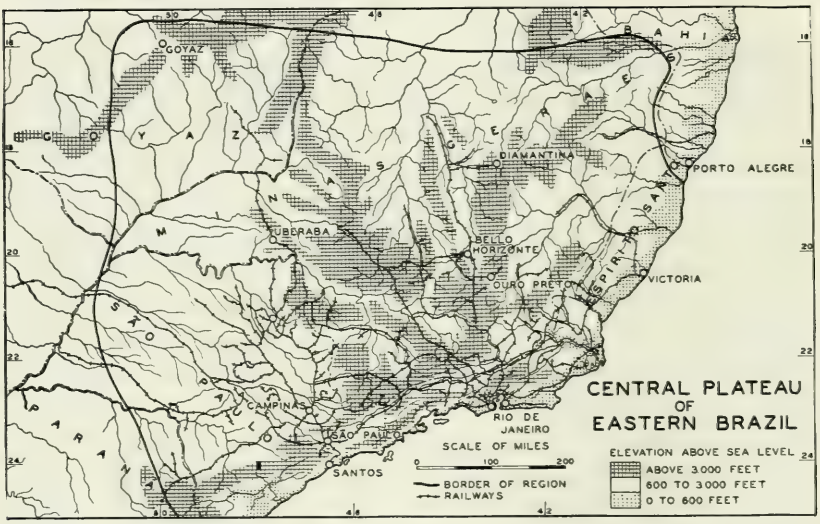

FIG. 197. THE CENTRAL PLATEAU OF EASTERN BRAZIL

The Central Plateau of Eastern Brazil possesses the second greatest railway net in South America. The many railway spurs leading into the rolling plateau lands serve the numerous coffee estates located on the slopes between 1,800 and 2,500 feet.

over much of the plateau; these districts experience the temperatures characterizing their location in subtropical latitudes; hence, they have contributed less to agricultural advance in the Central Plateau of Eastern Brazil.

Since in the plateau portions much of the precipitation takes place in the spring and summer and the pronounced dry season of autumn and winter facilitates the proper preparation of the berries, the seasonal distribution of rainfall has fostered materially the spread of coffee culture. Corn, cotton, and rice profit also by the dry season period of bright sunny weather. On the other hand, in the coastal areas the production of sugar cane indicates the greater uni-

formity of seasonal rainfall, of relative humidity, and of high temperatures.

On the whole, temperatures appear less advantageous. Occasional frosts may occur, though on the whole winter temperatures average some 60° to 65° F. Plantations have therefore become grouped in the upland districts at altitudes between 1,800 and 2,500 feet above

FIG. 198.

The eastern and southern parts of the country have nearly all the cultivated land of the nation; compare this map with the maps of crops and animals; Amazonia and the Campos possess mere patches of tilled crops compared to the vast plantations of other sections.

sea level; but the valleys which are subject to the cold resulting from temperature inversions have undergone little agricultural development. Summer temperatures may exceed 100° F, although in general extremes are not common; those of the upland surpass those of the coastal area; the less intense insolation of higher latitudes, as contrasted to the other coffee lands of tropical America, does away with the necessity for shading coffee trees.

Vegetation for the region as a whole is conspicuously lacking in uniformity. The eastern slopes support an almost impenetrable riot

of tropical rain forest, the *matta*. To early settlers this growth was a barrier of first magnitude. On the plateau various formations hold the land, depending upon soils and climate. The major characteristic is variety. The northern sections in Minas Geraes and Goyaz as well as part of São Paulo are savannas of the Campos type, although the very highest portions may be clothed in dense rain forest. In southern São Paulo, the *Araucaria* is an important component of the plant life, together with numerous hard woods and an undergrowth of ferns, bamboos, and *yerba matê*.

OCCUPATIONS

The Central Plateau of Eastern Brazil is pre-eminently an agricultural land. Nevertheless, various other industries are of considerable importance. The forests and mines have yielded much wealth and still hold great reserves. Manufactures have reached the most advanced stage in all South America.

In spite of the fact that the Central Plateau of Eastern Brazil includes one of the major corn-producing areas of the world, supports a large production in beans, rice, sugar, and cotton, and has developed considerable grazing industries in cattle and swine, coffee possesses economic significance to Brazil surpassing by far that of all other regional interests combined;[2] it occupies 41 per cent of the cultivated land of the region (Fig. 198).

[2] LAND IN CROPS (1920)
(Thousands of Acres)

	São Paulo	*Minas Geraes*	*Rio de Janeiro*	*Espirito Santo*	*Goyaz*
Cultivated land	4,712	3,275	712	537	285
Coffee	2,460	620	485	380	26
Corn	1,332	1,292	145	130	171
Beans	460	265	42	20	27
Rice	497	195	20	12	63
Sugar	71	281	53	28	15
Cotton	246	11	1	1	3
Cassava	21	17	20	13	6
Potatoes	15	4	2	...	...
Wheat	7	....	5	7	...

(Compiled from *Recenseamento do Brazil, Vol. III (2a Parte)*, pp. 246–335, *Agricultura, Ministerio da Agricultura, Industria e Commercio, Directoria Geral de Estadistica*, Rio de Janeiro, 1925. In many districts, the coffee plantations commonly produce subsistence crops among the rows of trees, so that acreages to some extent are duplicated.)

The Coffee Industry.—Coffee in Brazil has furnished the country the bulk of its export trade since 1840. In the earlier days principal agricultural activity in the region centered upon corn and sugar for local consumption, and upon cattle for some degree of export; major districts lay in southeastern São Paulo, comprising the upper valley of the Parahyba River and the land about Campinas, and in southeastern Minas Geraes. Following a period of comparatively slow, though prosperous, expansion, the production of coffee entered an era of unprecedented activity in the 1880's. This arose from the realization of the several factors fostering culture of the plant. *Fazendas* sprang up in large numbers; Italian colonization, to replace the emancipated slaves, increased enormously; systematically the *terra rossa* soils went under the plow. Soon the three coffee subregions became defined: (1) central São Paulo, upon the red or purplish soils proper, (2) the coastal foothills and spurs of the Serra da Mantiqueira and neighboring coastal highlands, (3) southeastern Minas Geraes (Fig. 199). Northeastern Paraná and southern Goyaz also have given part of their cultivated area in coffee. By the early years of the twentieth century Brazilian coffee, of which the Central Plateau produces practically all, had become the leading export commodity of South America.

Suitability of the Region for Coffee Culture.—In respect to physical suitability and consequent conditions of human culture, the region provides a land highly adapted to the large-scale production of coffee. Rolling topography provides air drainage and soil aëration; deep fertile plateau soils of high iron and potash content contribute additionally to the production of a coffee of superior flavor; so extensive are the areas of excellent soils that the practice following impoverishment consists simply of abandonment or planting to other crops and the removal of the plantation to a new site cleared in the forest.

In the autumn the dry, sunny, warm weather favors the harvesting, washing, and drying processes. As contrasted to the need for several pickings in other regions, berries here ripen practically simultaneously. The heathfulness of the region encourages the growth of an energetic population. Immigration, the development of rail transport following boom years subsequent to 1885, and governmental aid have further emphasized the adaptability of the region to coffee production. The one railway from the coffee region to Santos, how-

ever, in addition to imposing a monopoly upon the region, has become unable to handle the increasing volume of traffic. Unfortunately, difficulties of construction in the rugged country connecting plateau and coastal plain may delay establishment of a government-owned

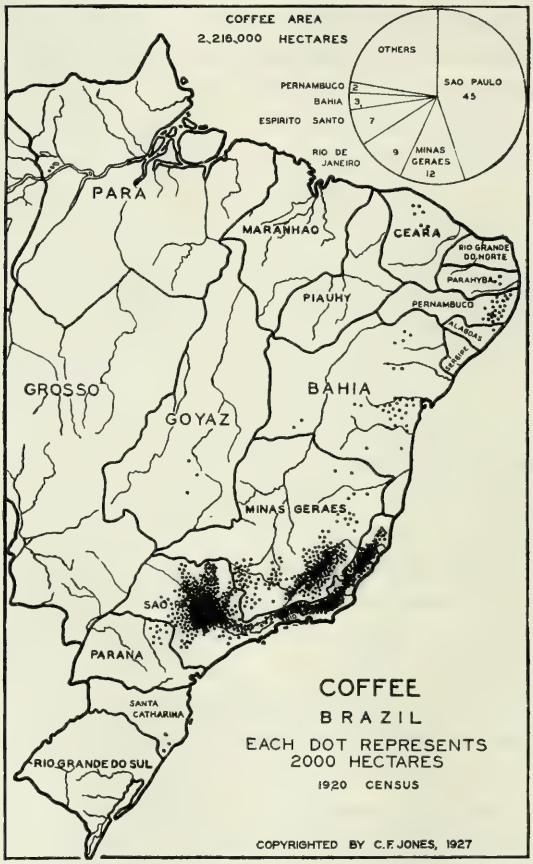

FIG. 199. DISTRIBUTION OF COFFEE IN EASTERN BRAZIL

railway for many years. Moreover, the tendency towards overplanting and consequent overproduction, an outgrowth of unusual physical suitability and mode of land tenure, has also brought about various problems.

Methods of Coffee Culture.—The quantities of hand labor required, the number of processes preceding shipment of the beans, and the

need for considerable capital, cause the coffee-producing lands to support extensive *fazendas*—units well adapted to coffee culture, but which hinder necessary diversification of agriculture, as has resulted from the *latifundia* system on the *estancias* of the Argentine Pampa.

Immigrant labor, living in villages on the estate, care for the crop. In general, each colonist receives an allotment of some 2,000 trees, representing an area of 5 to 7 acres. Since there are almost 2,000,000,000 trees in the states of São Paulo, Minas Geraes, Rio de Janeiro, and Espirito Santo, the demands for labor present a grave problem. Owing to the abundant rains of summer and the resultant growth of weeds on the fertile soils, the laborers during the season of cultivation work principally at weeding. They receive a stipulated sum of money and the privilege of growing corn and beans, staples of their diet, between the rows of young coffee trees, prior to the period of bearing, beginning in the fourth year. Of late the labor situation has changed considerably, for the spread of machinery on *fazendas* increases. Contributing factors include the competition for labor caused by the rapid urban growth of the city of São Paulo and the lure of higher wages and more favorable rates of exchange in Argentina.

This drainage of labor supplies becomes especially serious in the harvest season, for only hand labor can provide for picking the berries. This period commences generally in late June; since the well-defined seasons cause the entire crop to reach maturity almost at the same time, a feature conducive to quality of product, larger forces of labor are needed than would be the case in a more prolonged ripening interval as characterizes some of the other coffee regions of Tropical America.

After removal of skins and pulp, washing and drying, and sorting of the beans, the crop is ready for sacking. In the process of drying, particularly, regional advantages for coffee culture become evident. The blackened tiles of the drying-grounds, or *terreiros*, become intensely warm under the blazing sun and cloudless skies of the winter season. In addition, low relative humidity and frequent gentle winds promote evaporation. At times conditions prove less auspicious and the drying period may vary from a few days to weeks. Constant watch is kept of the weather, and when advisable canvas covers protect the beans against rain or high wind.

The net result of the manner of production arising from the physical conditions of the region is indicated in the growth of Brazilian coffee production, in recent years representing 65 per cent of the world crop. The phenomenal rise in coffee shipments resulted from (1) the destruction of the coffee industry of Ceylon by the blight, (2) the growing consumption of the beverage in the United States and northwestern Europe, and (3) the stupendous scale of planting on the coffee lands of São Paulo (Fig. 200), a scale of planting responsible for the difficulties of the Brazilian coffee industry of the twentieth century.

Valorization of Coffee.—The basis for the first coffee crises lay in the method of remuneration to colonists. Under the usual system the cultivator managed the land for 5 years, at the end of which period he returned it to the owner with the coffee trees in bearing. The colonist received a small fixed sum of money plus the crops which he raised during those years; in order to retain his laborers the planter had to continue setting out trees. Consequently the number of trees and the production of coffee soon grew out of all proportion to the demands. From 1896 to 1906 world production increased from 10,000,000 to 23,800,000 bags; in the latter year there existed a reserve from previous crops of 11,500,000 sacks. In order to avert a disastrous crisis the government entered the market and bought 8,500,000 sacks, which it warehoused and sold later at a profit. Because Brazil so completely dominated the world in coffee exports, the withdrawal of this huge amount of coffee from commercial channels forced the price of coffee in world markets to rise.

Variability in world markets, the difficulty of curbing planting in the region, and the expansion of the industry in competing lands made resort to governmental aid necessary in 1917, 1921, and again in 1922. This policy has reacted to the very definite harm of the region, for it has encouraged additional planting of coffee and has discouraged diversification of crops. Besides, the government began to restrict shipments of coffee to Santos by erecting 9 warehouses in the interior of the country where coffee was stored to await shipment. Thus regulating the market, the government took over control of coffee. Before valorization 85 per cent of the coffee reached Santos within 6 months after harvest; now it must be stored in government warehouses in the interior and is released only by official order.

FIG. 200. A VAST SEA OF COFFEE, SÃO PAULO

In the rolling plateau of São Paulo are 1,000,000,000 coffee trees with space for 5,000,000,000 more. Can the Institute for the Permanent Defense of Coffee cope with a marked increase in production and hold up the price of coffee for all the world, or will the coffee flood finally break up the political manipulation of price and supply and cause a revolution in agriculture in the central part of eastern Brazil, to the advantage of the republic? (*Courtesy of Instituto de Café, Estado de São Paulo.*)

The final step has been the organization in São Paulo of the "Institute for the Permanent Defense of Coffee," which makes loans to planters on easy conditions, regulates deliveries to Santos, purchases coffee for retention from market, and collects taxes for carrying on propaganda to increase foreign consumption of Brazilian coffee. After repeated attempts the São Paulo Institute for the Permanent Defense of Coffee succeeded in 1928 in getting the growers of Rio de

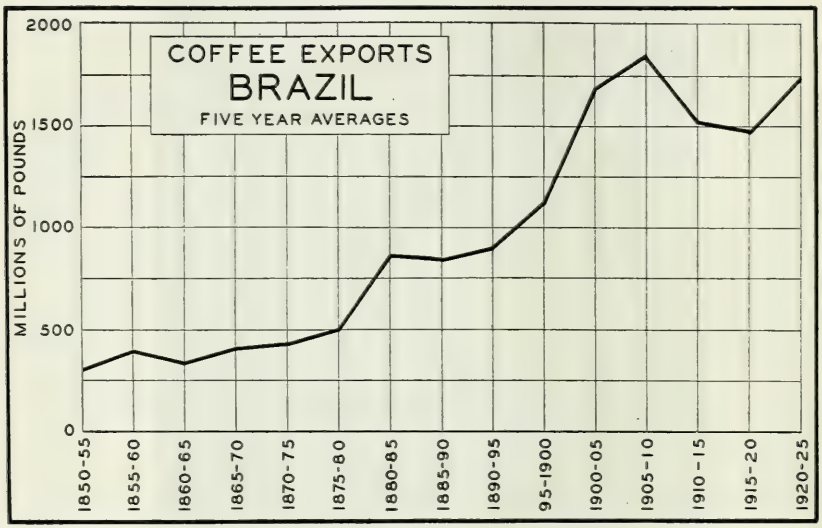

FIG. 201

Brazil had a remarkable increase in coffee export of from 300,000,000 pounds in 1850–1855 to 1,850,000,000 in 1905–1910, the high-water mark in the coffee trade. The first crisis in the industry came in the decade 1900–1910 with overproduction and the decrease in the price of coffee. (*From "Commerce of South America," Clarence F. Jones; courtesy of Ginn & Company.*)

Janeiro, Espirito Santo, Minas Geraes, and Goyaz to cooperate fully in the various functions of the Institute.

What has valorization accomplished? It has repeatedly bolstered up the price of coffee and saved *fazendeiros* from ruin in times of special stress, but it cannot relieve permanently the financial stress of overproduction. More and more the large agricultural interests become aware of the dangers of a one-crop economy and of the exceptional advantages of the region for crops other than coffee. The growth of manufacturing in Brazil and the recent infestation of more than 200,000,000 trees in the state of São Paulo by *stephanoderes*, a

destructive plant pest, have decidedly furthered this trend (Fig. 201).

The needs of the coffee industry number: (1) an improvement in the types of machinery used, thus lowering the cost of production and offsetting the shortage of labor; (2) a diversification of crops in the coffee regions, thus affording a better use of labor and machinery, and reducing proportionately the cost of farm operations now charged to coffee; (3) careful inspection service to prohibit the shipment of coffee by growers who do not fumigate coffee infested with *stephanoderes* and who do not clean up infested plantations; (4) the breaking of the São Paulo Railway concession, which prohibits any other road from Santos to São Paulo; and (5) the adoption of certain measures to reduce further the cost of production, thereby aggressively meeting competition from other areas and capitalizing on the exceptional advantages enjoyed by the coffee industry in Brazil.

Other Crops.—Its ease of production and high degree of utility as food render corn the second crop of the region, the acreage averaging four-fifths of that in coffee. Practically all of the corn remains within the region for use in the daily meals of the lower classes. Although primitive methods characterize its cultivation over most of the region, in accord with general progress in agriculture improved methods have been introduced; being a good pioneer crop, corn generally provides the first crop on newly cleared or burned-over land. Later, it may be cultivated between rows of young coffee trees. As with coffee, the well-distributed rainfall of the growing season and the relatively dry ripening and harvesting period greatly favor the crop.

Cultivated like corn everywhere in the region, beans of a black variety enter into daily diet among the poorer classes and are eaten with rice, corn, and other foods. In many cases both corn and beans grow in the same field, frequently on abandoned coffee plantations, the corn plant furnishing the bean a support upon which it may climb. Considerable possibilities for the rehabilitation of exhausted agricultural lands lie in the nitrogen-fixing capabilities of the legume, but as yet abundance of rich new lands and disinclination of large-scale producers sustain an unprogressive regard towards the use of fertilizers.

Now third among the important food crops, rice has furnished a

profitable means for the diversification of agriculture. Although a small production of lowland rice characterizes coastal and river valley districts, upland rice is the usual crop, more particularly in districts settled by Japanese. A major concentration lies in northern São Paulo, where rice culture has spread markedly in recent years, for it constitutes the staple food in many districts. Exports already reach considerable totals (Fig. 202).

For centuries an especially valuable crop in the lower Parahyba Valley in Rio de Janeiro, sugar has advanced into the plateau dis-

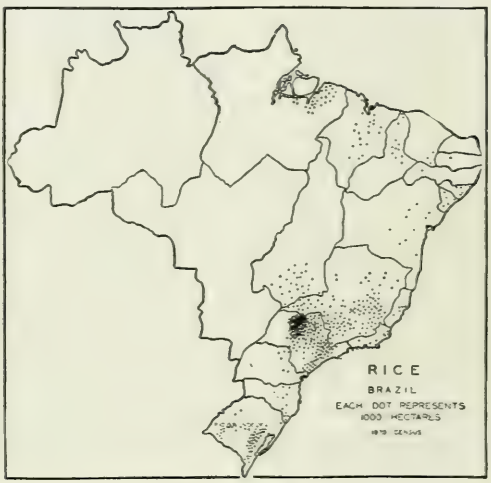

FIG. 202. RICE ACREAGE

The Central Plateau of Eastern Brazil has a large share of the rice production of the nation; much of the crop consists of upland rice.

tricts of eastern Minas Geraes and central São Paulo. Besides the ample rainfall, the fertile red plateau soils, and the clay alluvial soils of the "campos," the region affords several favorable factors. As a crop succeeding coffee on the plateau, it thrives exceedingly well; the careful preparation and weeding of the land needed for coffee provides exceptionally fit conditions for the cultivation of sugar (Fig. 203). The large local population assures a ready market. Competition with other regions closely limits exportation of surplus production. Primitive methods of cultivation prevail and the majority of the mills operate with old inefficient equipment.

Still a minor crop in acreage, cotton has awakened much interest

as a possible cash crop other than coffee. Though less developed than that in Northeast Brazil, the cotton-producing industry as here localized in central São Paulo has opportunities for notable growth. As grown in the region, American upland cotton yields a one-inch fiber and suffers by comparison with the long-staple tree cotton of the northern area; nevertheless it provides an excellent crop for the coffee lands. Soils and distribution of rainfall prove distinct benefits; cotton profits as much from the fortunate autumn dry season as coffee; the absence of cotton cultivation in the coastal sections indicates the effect of the lack of a pronounced less rainy season. The crop may be planted between rows of coffee trees, and in many districts its

FIG. 203. HARVESTING SUGAR CANE

Along with cotton, sugar cane has assumed a significant place in the agricultural economy of the coffee region of Brazil. (*Courtesy of the Pan-American Union.*)

small labor requirements as compared with coffee favor its establishment as a principal crop. The growth of the Brazilian cotton-manufacturing industry, which has a large domestic market, enhances further the fitness of cotton as a crop in the region; but to attain considerable importance in production, methods of production and marketing must undergo much improvement.

Relatively unimportant in acreage and as articles of diet, cassava, the potato, and wheat augment the list of food crops. A highly productive and easily cultivated crop, cassava gives much of the region its principal starch food, notably in the hot lowlands of Rio de Janeiro and Espirito Santo. Lower temperatures and less abundant rainfall, however, restrict its production in the plateau and encourage the cultivation of potatoes instead. At the same time, temperature is too high and rainfall too great for profitable culture of wheat.

Rearing of Livestock.—Though markedly subordinate to cultivated crops, the livestock industries possess much significance in feeding the 16,000,000 inhabitants of the region. They contribute to the utilization of extensive areas of Campos grasslands in southern Minas Geraes and Goyaz, which lie at an elevation too great for coffee culture (largely over 3,000 feet above sea level), and furnish power for cultivation.

At present comprising nearly 30 per cent of all the cattle in Brazil, the cattle industry of the Central Plateau of Eastern Brazil has

Fig. 204. Pure-bred Beef Cattle, São Paulo

The introduction of high-grade cattle into eastern Brazil in large numbers will go a long way towards a more complete utilization of the resources of this vast country. (*Courtesy of the Pan-American Union.*)

experienced a long evolution from the time that it found the leading industry in the days of frontier settlement in São Paulo. Though a large portion of the 9,000,000 animals are used chiefly for draft purposes, the growth of population has caused a large increase in the production of meat, especially in the districts producing relatively little coffee. Moreover, as in the Great Plains-Corn Belt population center movement of cattle in the United States there exists a flourishing area about São Paulo City devoted to the fattening of cattle from the Campos Grazing Region, either for local consumption or for shipment abroad. As a whole, the industry promises much growth; the mild climate permits open winter grazing, forage is available throughout the year, transportation facilities surpass those of other parts of

Brazil, and large domestic and foreign markets offer numerous opportunities (Fig. 204). Although the cattle are inferior to Argentine stock, the introduction of pure-bred Hereford and Shorthorn stock has progressed rapidly in recent years, ranges have been fenced, foreign capital has become interested, packing plants have been constructed, and steps have been taken to reduce the ravages of insect pests and diseases.

Density of population, ease of production on a small scale, and urban markets account for some 7,500,000 swine raised in the region, in the main in those districts supporting the major concentrations of cattle. Fed on corn and allowed to root for a living in the woods, the animals afford a local meat supply as well as a source of exports. Thin, large-boned, and fattened with difficulty, the stock nevertheless offers many opportunities.

Mining.—The exploitation of minerals in the region has had a varied development. Gold and diamonds first claimed attention; they are still produced in variable quantities. Gold occurs in many parts of Goyaz and southern Minas Geraes and the effects of its early discovery have left a permanent stamp upon these lands. Operations included, first, placer mining and, later, work on the basic sources. The major scene of activity lay about Ouro Preto in southeastern Minas Geraes, a town which has followed the course of many other mining centers, declining in population from 60,000 at its most active days to some 15,000 at present. Rapid exhaustion of easily worked deposits caused this decadence in the industry as a whole. As in all Brazilian mineral industries, poor transportation facilities and lack of capital have hindered possible growth. Diamonds have had a similar evolution, centered about the town of Diamantina in central Minas Geraes.

It is to iron that this region and Brazil look for future great development. The central Minas Geraes deposits alone, among others in the region, have resources estimated at 12,000,000,000 tons of high-grade hematite ore much of which averages 60 per cent iron. A single deposit has 500,000,000 tons. The region easily contains the largest undeveloped resources of iron ore in any country of the world. Nevertheless, the iron and steel industry of Brazil is practically nonexistent, in the face of huge imports of iron and steel goods. In the early nineteenth century, a number of charcoal furnaces supplied

various products to the interior. But abolition of slavery and increasing importation from the coast closed practically all of these plants. The principal obstacle in the way of a large industry is the lack of coking coal. Electric smelting already has been attempted, but large-scale production is far distant. As for shipping the ores abroad for smelting, difficulties abound. The deposits lie some 250 to 350 miles from ports and the one railroad in the district is not equipped to handle a huge volume of ore. With the construction of an adequate rail line to the coast, Brazil could furnish great quantities of ore to the world. Despite present conditions, in all probability a domestic iron and steel industry of some importance will arise because of the rapid advance of manufacturing in general, the great demand for iron and steel goods, and the size of Brazil's population. São Paulo already fabricates quantities of nails, screws and bolts, chains, wire fencing, agricultural implements, doors, safes, stoves, and a variety of general foundry production.

The leading mineral industry at present is the production of manganese ore, chiefly for use in the iron and steel industries of the United States. The ore bodies lie chiefly about the iron districts of Minas Geraes and are of considerable size, Brazil already supplying a large part of world requirements in competition with Russia, India, and the Gold Coast. Exports total more than 300,000 metric tons per year and promise great growth with improved rail connections.

Manufacturing.—The Central Plateau of Eastern Brazil has the most advanced manufacturing enterprises of South America. These, however, are inconsiderable in view of the huge deposits of high-grade iron ore, the many other basic minerals, the immense water-power resources, and the extensive forests available. Paucity of fuels is the great handicap; coal and petroleum make up 12 per cent of all Brazilian imports. Some 300,000 tons of coal, one-sixth of domestic needs, come each year from the Santa Catharina and Rio Grande do Sul mines, but despite its low quality this coal costs as much in Rio de Janeiro as the best Cardiff or Pocahontas coal. Hence, many industrial enterprises operate wholly on wood as a fuel.

The underlying reasons for the leadership of Brazilian industry, or more particularly Central Plateau industry, lies in the size of the population served, the richness of lands, and the growing use of water power facilities. A peopling of 39,500,000 for the country and one of

FIG. 205. SANTOS, BRAZIL, THE GREAT COFFEE PORT

Along the water front stretch the long rows of coffee sheds; in the background rises the Serra do Mar; the great flow of coffee has caused the rise of a modern port and city in a former pest-hole of yellow and malaria fever.

16,000,000 for the region afford no mean market for manufactures, despite the low purchasing power of most of the inhabitants. Furthermore, the wealth produced by coffee *fazendas* conduces to investment in other fields and also attracts the attention of possible foreign capitalists who realize the opportunities for manufacturing.

Most of the infant industries of Brazil have been developed under the protection of a high tariff. The import duties on many classes of goods increase the price of the commodity from two to four times the price in the country where it was produced. Consequently cheaper grades of goods manufactured in Brazil under handicaps due to labor, capital, and management can hold the market over such imported articles. The factories of the republic now supply 90 per cent of the cotton textile requirements, much of the jute and some of the woolen goods, and nearly all the boots and shoes, beverages, hats, tobacco, and furniture.

The textile industries are much the most developed in the region. All types of goods are produced, but the strength of the manufacturers lies in the cheaper coarse goods suitable for the great mass of the population, and in these lines the domestic mills enjoy a monopoly. Moreover, the industry progresses steadily. In 1927, the cotton mills of the region had 2,000,000 of the 2,600,000 spindles in Brazil; the state of São Paulo, the Federal district, Minas Geraes, and the state of Rio de Janeiro had respectively 814,000, 734,000, 223,000, and 221,000 spindles, operating mainly on hydro-electric power. The São Paulo output amounts to 40 per cent of the value of the entire production.

The manufacture of cotton goods is favored by the available domestic sources of raw cotton. On the other hand coastwise transportation charges are high. In addition, many of the mill owners lack experience, and much of the labor is unskilled.

THE FUTURE

Preeminence of the Central Plateau of Eastern Brazil among the several sections of the country arises from factors which will assure continuance of its significance for a long period. In a region which with respect to healthfulness over an extensive agricultural area probably excels any other region of the world in similar latitudes, the growth of population based upon European stocks and the consequent

development of agriculture, transportation, and manufactures augur well for the future. The power of Brazilian coffee in world markets and the suitability of the rolling lands of the plateau for its culture indicate prolonged predominance of the coffee industry (Fig. 205). Nevertheless, the diversification of crops which has begun will contribute materially to the advance of the region. As conditions favor the utilization of water power, iron ore and other minerals, forests and other raw materials, manufacturing will advance rapidly. In all, the region clearly displays a conspicuous capability for meeting the requirements of its own inhabitants. Moreover, as a source of agricultural commodities for the world and in all probability as a producer of certain manufactured wares for other South American countries, its horizon constantly spreads.

CHAPTER XXXII

THE RAINY COAST OF BAHIA

Today the Rainy Coast of Bahia is the smallest of the several major geographic provinces of Brazil. In comparison with such areas as the Central Plateau of Eastern Brazil and Northeast Brazil, its present and potential significance seem limited. Yet less than 200 years ago, here lay the heart of Portuguese Brazil. Throughout its history following colonization, the region has produced essentially the same types of commodities, although with varying importance for each; they comprise chiefly cacao, tobacco, sugar, and timbers.

With the basis of sugar produced about its fine harbor on the Bay of All Saints, by the end of the sixteenth century, the city of Bahia became the leading center of Brazil and until 1763 was the capital of the colony. Bountiful fertility of soils, slave labor, and ready European markets carried the land along on a wave of prosperity. Not only did the city of Bahia acquire the sugar trade, but it also became the principal slave market for all South America, a fact notably evident in the high proportion of negro blood in the population. Abolition of slavery in the late nineteenth century and growing competition in sugar markets destroyed the power of sugar, but its cultivation continued together with tobacco and various small crops; and to the south of the sugar zone arose the new major industry of the region—the production of cacao. Owing to the considerable sphere of influence of Bahia City and the ease with which the emancipated slaves gained a livelihood on the fertile lands among the lower slopes of the Serra do Mar, much of the east has continued to be one of the most densely settled districts of the continent. The state of Bahia has a population of nearly 3,500,000, most of whom live in this region. The capital city is easily the third city of Brazil, with a population of 320,000, an important manufacturing center for tobacco, sugar refining, cotton, and jute. In addition, this lively metropolis has a large trade growing out of its connections by rail with the interior of the state, whence come various products, notably diamonds,

and by coastwise steamer with the several small cacao ports to the south and the cotton and sugar districts of Sergipe to the north. With respect to cacao, Bahia has lost rank, owing to the rise of Ilheos, a small port of 7,000 people to the south, which now ships directly more than half the cacao crop of the state.

Though the city of Bahia owes much of its importance to comparative ease of access to producing districts, the region as a whole has inadequate transportation facilities. Most of the 1,200 miles of railway in the state lies in the less productive portions. The important cacao zones have no direct rail connections with the capital and the productive sugar and tobacco fields about the Bay of All Saints depend upon a line able to accommodate only a small part of possible traffic. Though the availability of several small ports and their proximity ameliorate the lack of good transport, nevertheless a well-developed rail system would greatly increase the production of these rich lands.

THE PHYSICAL CONDITIONS

Relief and soils in this region present a variety of conditions. The portion south of the Bay of All Saints consists of two parallel belts. Bordering the coast is a narrow belt of unconsolidated alluvial and marine sediments of rather recent age.[1] Under the influence of a humid tropical climate, these have given rise to strips of clay and sandy soils of varying degrees of fertility. A considerable part of the plain consists of sandy ridges and marshy stretches. To the west rises the Serra do Mar, which is composed chiefly of ancient granites and metamorphic rocks, especially gneiss and mica-schists, developing under the rainy hot climate a deep heavy brown to red soil. Rolling to rough lands, the ranges of the Serra do Mar in this latitude are broken by several major streams, including the Mucury, Jequitinhonya, Prado, and Rio de Contas. A zone of low rolling hills of cretaceous argillaceous schists giving rise to a heavy gray to brown clay soil lies about the Bay of All Saints. Inland, this zone grades into the tableland of sandstones and clays, in general of low fertility, and farther inland lies the undulating old crystalline area (Fig. 206).

A primary cause for the localization of agriculture in eastern Bahia

[1] The sands of the coast at one time supplied most of the monazite requirements of the world. After 1922, however, production has been nil. The decreasing use of incandescent gas mantles, in the manufacture of which this mineral was necessary, and the exhaustion of the richer sands caused the complete cessation of operations.

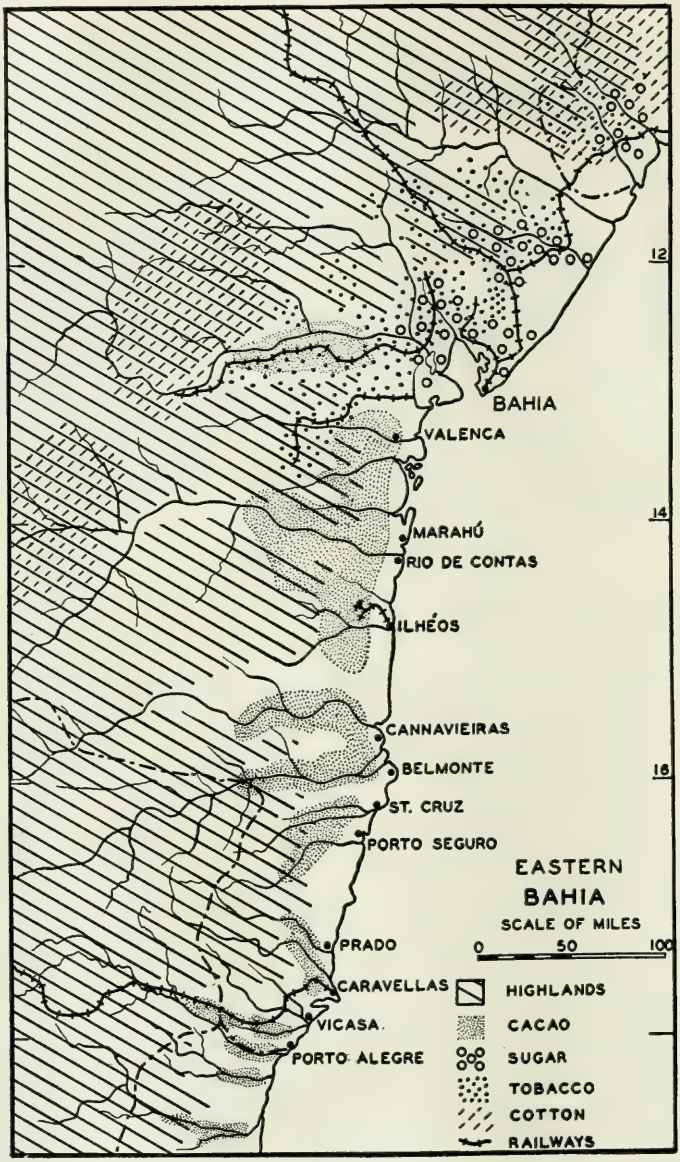

FIG. 206. THE RAINY COAST OF BAHIA

An old sugar and tobacco region, the coast of Bahia has developed as a great cacao region. The cacao districts of east central Bahia occupy the alluvial plains and extend up the steep slope of the eastern range of the Brazilian highlands. (*Cacao districts after Wanderley de Aranjo Pinho.*)

lies in the extent of alluvial deposits which in point of area have no rival for several hundred miles south. The numerous rivers descending the interior crystalline plateau have assisted in providing the sands and clays of these coastal lands and in facilitating intercourse between the sea and the Campos grazing land, a source of labor during the cacao harvest period. Advancing first in the alluvia of the valleys, the cacao industry spread gradually to the lower slopes of the coastal hills to a maximum elevation of some 1,000 feet onto the well-drained deep soils preferably of siliceous clays affording favorably high contents of phosphoric acid and potash. Tobacco and sugar culture, in the district west of the Bay of All Saints, developed upon the deep and fertile clays characteristic of the hills of the Reconcavo, while coffee is produced on the higher interior lands encircling the bay.

Lying as it does between 12° and 18° S. latitude and in the face of the constant southeast trade winds, the entire region has a hot and humid climate. The coastal plain has mean monthly temperatures ranging between 73° and 80° F. To be sure, temperatures decrease with elevation in the mountains, but since the entire region lies below 5,000 feet, the temperatures are distinctly tropical. Practically all of the land receives from 50 to 80 inches of rain per year, the precipitation being heaviest to the west and south of Bahia. It is uniformly distributed seasonally in the south so as to favor cacao; but with a distinctly drier period between September and February in the north, it excludes cacao and permits tobacco culture. In addition, the uniformly high temperatures of a humid tropical region prove favorable to the moisture- and heat-requiring cacao, and the tropical rain forest of much of the area provides shade and protection against winds, requirements quite necessary for the cacao tree, the source of the chief product of the rainy coast.

The region as a whole supports a rainy trade-wind forest, but details vary from section to section (Fig. 207). Along the coast lie rather narrow strips of scrubby vegetation, the trees poorly developed and their branches burdened with epiphytes; in some places are mangrove forests and in others strips of savanna lands. The main body of the eastern coastal forest begins about 10 to 15 miles inland, and extending up the slopes and valleys of the coastal mountains increases with elevation in number of species and quality of the trees up to 3,000 feet. Variety, size, and density of the stand surpass that of the

Amazon basin. Tree diameters run from 2 to 3 feet, clear lengths about 50 feet, and total heights to more than 300 feet.

While there are 50 or more species of woods which have already achieved commercial importance, about 30 per cent of the volume of

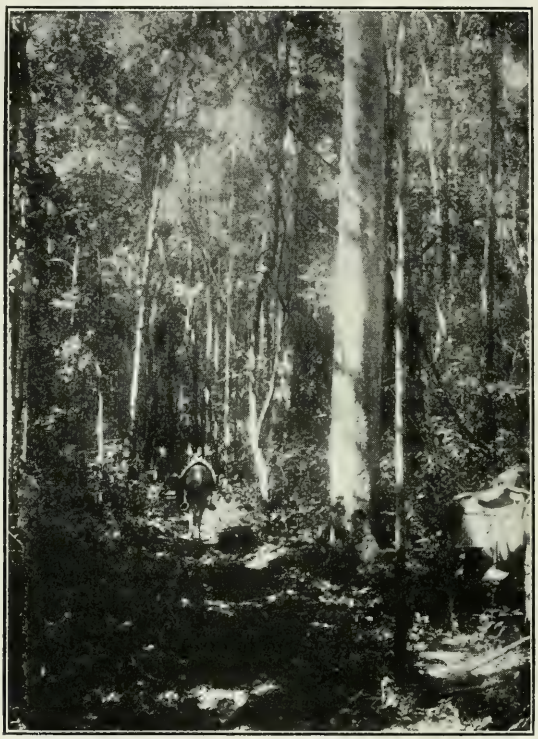

FIG. 207. THE RAINY TRADE-WIND FOREST NEAR RIO PREGUIÇA, BAHIA

In number of species and stands the rainy trade-wind forests of Bahia rival those of the Amazon Basin. The more accessible portions of this forest area contribute structural materials and other products for Central Brazil. (*Courtesy of C. F. Marbut.*)

the stands in some localities consists of five kinds of wood—juquitiba (*Courantari spp.*), sapucaya (*Lecythis spp.*), goncalo alves (*Astronium graveolens* and *A. fraxinifolium*), vinhatico (*Enterolobium spp.*), and peroba (*Aspidosperma spp.*).

AGRICULTURE

Possibly more dependent upon a single crop than the Central Plateau of Eastern Brazil, the Rainy Coast of Bahia supplies more

than nine-tenths of the Brazilian cacao exports, more than one-third of the national crop of tobacco, and quantities of sugar. It affords exceptionally favorable conditions for the cultivation of its principal products. Despite its prominence as the leading source of cacao in the Americas, the region supports a primitive type of agricultural economy. The scarcity of available labor, arising from the aversion of the natives to working for others, has resulted in a large industry based upon the production of the small-scale cultivator. Upon the land which he has cleared of its forest growth, the cultivator and his family, in addition to cacao, produce subsistence crops of corn, beans, cassava, melons, and bananas; wild fruits add to the store of foods. Livestock contribute little to agricultural activity; swine and chickens fit best into the common method of production since they root or scratch for a living in the woods or fields; cattle areas in the higher lands to the west supply a low-grade beef.

The Cacao Industry.—Despite the striking suitability of the region for cacao production, the industry dates only from the later years of the nineteenth century. Prior to the 1880's, most of the present cacao area consisted of a virgin wilderness. When the influx of emancipated slaves from the northeastern sugar districts of the country occurred, interest in the crop increased; and as a result, by 1895, exports of cacao from Bahia had surpassed those of the Amazon areas; now 500,000 acres lie in cacao (Fig. 208).

Production of cacao consists first of the clearing of small patches of forest and the planting of a few trees in a favored site. Unsystematic and careless in his management of the crop, the native prefers a seminomadic life, with the result that the establishment of extensive plantations requiring a permanent working force involves many difficulties. The only practicable method of attaining large-scale production demands the purchase of many individual clearings set to cacao and their gradual linking into larger units. Generally the native who has cleared and planted an area is quite willing to sell his little holding for he can easily move to another site where in 5 or 6 years he has an additional stand of trees in bearing and available for purchase. In contrast to this roundabout practice, where plantations have become possible by reason of willingness of natives to remain on the land, careful methods of production prevail.

For the region as a whole, methodical tillage of cacao groves is the

exception, although from time to time the growth of weeds is removed with hoes. The necessity for shading the delicate leaves favors at least one element of proper cultivation and in some cases also provides a windbreak. Not only do the shade growths protect the trees but they also benefit soils in preventing undue evaporation and rapid decomposition of humus under the tropical sun. Furthermore, the foliage furnishes valuable humus, and should a legume be employed the soil obtains a supply of nitrogen. Notably evident negligence in culture

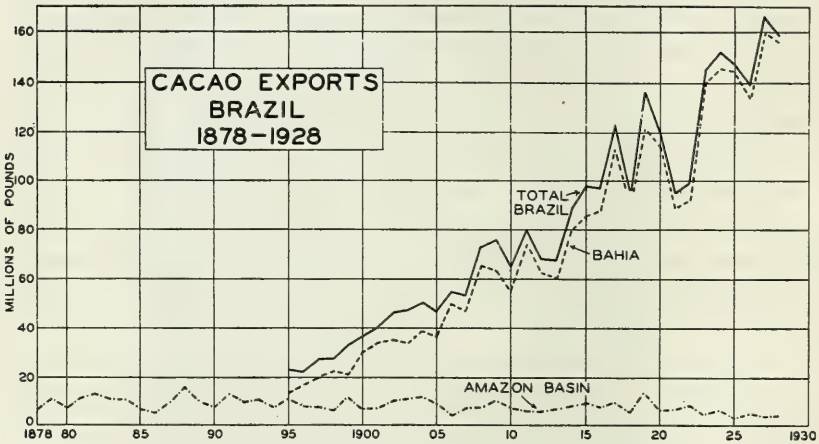

Fig. 208. Amazonia and Bahia Cacao Exports

The cacao industry of Amazonia has been on the decline since 1888, while that of Bahia has shown a phenomenal growth under favorable physical and economic conditions.

results in a considerable portion of the native crop reaching shipping houses affected by diseases and insect pests; various rodents also ravage the crops.

Throughout the primary stage in the production of cacao natural advantages enable the Bahia regions to excel other major cacao areas of the world, but between preparation of harvest and final marketing of the raw product, inadequate facilities and crude methods hinder the industry; important here are artificial restrictions imposed by state and federal taxes totalling some 20 per cent of the export price. These handicaps limit materially the ability of the region to compete with such favored areas as the Gold Coast, where in addition to a superior agricultural economy, governmental encouragement obtains.

Other Crops.—Here and there in the forest clearings and near the small ports corn, beans, cassava, and other products are grown by crude methods in small quantities for local consumption. This is especially true in the mountains of the southern part of the area having a population density of less than four per square mile. To the north and west of the Bay of All Saints, an area having a population density of around 50 per square mile, much of the forest has given way to sugar lands, general farming in a desultory fashion, and to cacao plantations. Crude farming methods, poor machinery and equipment, and much rain at cutting time retard the development of sugar culture in spite of a dark calcareous clay soil of good fertility and fair working qualities. With increased forest clearings, cacao plantations may be established farther south in the deep humid valleys of the Serra do Mar, but coffee does not find here the exceptionally favorable conditions of soil, temperatures, and rainfall distribution as it does on the São Paulo plateau.

Less hampered by dependence upon foreign markets, the tobacco lands, though poorly managed, profit by proximity to the leading port of the state of Bahia. The principal producing districts, totalling approximately 75,000 acres, lie to the northeast of the mouth of the Paraguassu. Bahia tobacco occupies a favored position in European markets as well as in domestic trade so that production increases constantly.

LUMBERING

Many small mills have been constructed along the streams on the coastal slopes and in the mountains, and the forest thins out in the face of the saw and ax. On typical stands in Bahia, averaging 8,000 to 10,000 board feet per acre, 1 per cent of the timber cut has properties and uses similar to rosewood; 10 per cent similar to mahogany; 20 per cent resembles hickory; 40 per cent, birch, maple, beech, and ash; and about 10 per cent Spanish cedar. Besides supplying a local demand for a variety of uses, the forest products go chiefly to cities and towns of the Central Plateau Region for structural purposes, interior finishing, and furniture. A few of the more valuable woods move to markets in the northern hemisphere.

Should ever-lurking disease or insect pest flare into dangerous prominence, the trend towards over-emphasis of the principal cash

crops of the region may precipitate an aggravated crisis. Much opportunity nevertheless exists for improvement of production, transportation means, and marketing; development of these together with a possible alteration of strangling tariffs may initiate an era of great progress in the cacao industry. Tobacco also, now the second crop of the region, to a far greater extent than coffee or sugar, has a secure basis for extension of culture in the heavy consumption of the product within Brazil, in other South American countries, and in European

Fig. 209. Rolling Land, Jequié, on Rio dê Contas

On the western margin of the rainy, coastal region of Bahia. On the fertile, red clay soils of this area tobacco of long standing still engages the attention of large numbers of people. (*Courtesy C. B. Manifold.*)

markets. For the region as a whole, the dangers attendant upon continued exploitation of one or two principal crops possess relatively little significance in the present stage of development because the agricultural population evinces disinclination towards prolonged residence in one area, and it produces food crops in small clearings in quantities sufficient to supply local needs (Fig. 209).

The forest industries of the coast may experience considerable expansion with more modern mills, better methods of curing lumber, increased transportation facilities, and growing demands in the plateau to the south. Furthermore any developments in western Bahia will enhance the significance of the Rainy Coast of Bahia, since the hinterland has contact with the outside world through cities and ports along the sea.

CHAPTER XXXIII

NORTHEAST BRAZIL

Like the lands of the Rainy Coast of Bahia, Northeast Brazil has had an important place in the history of the country, relatively far more important in early days than at present. Here also, utilization of slave labor on sugar plantations gave rise to a noteworthy grouping of population, especially on the coast. Although the liberation of its labor supply dealt the sugar industry a severe blow, favoring conditions have sustained its development so that the region produces the bulk of the Brazilian sugar crop. In addition, the dissimilarities in climatic characteristics of various parts of the area give other products considerable significance, principally cotton and livestock commodities.

A basic factor in the early settlement of the region lay in the proximity of the coast to Europe; Recife (Pernambuco) lies closer to Europe than any other large port of South America. When to this was added the comparative ease of taking up land where no Serra do Mar blocked progress, the early colonist had many reasons for establishing a domicile. Hence Northeast Brazil early had the largest population of all the major sections of the country. The rise of coffee has given the lands of the Central Plateau of Eastern Brazil a far greater present population, but certain parts of the northern area remain the most densely peopled in the country. Neither the rich Campos district of Rio de Janeiro nor the heart of the São Paulo plateau supports a concentration of population so striking as that in a large district adjacent to Recife. Though not greatly larger, the region has twice as many people as South Brazil. Owing to the conditions affecting early industries, Northeast Brazil as a whole has acquired a distinctive population. The coastal districts, the zone of sugar and cotton plantations, have a high proportion of negro blood, while the predominantly grazing lands of the interior have almost exclusively the descendants of crosses between early Portuguese colonist and indigenous Indian.

Though originally each coastal settlement had its tributary zone of livestock to supplement the chief interests in sugar cane, tobacco, or cotton, the city of Recife came to gain the ascendancy. The location of this center in the heart of a productive agricultural district and its control of rail and sea routes have made Recife the collecting and

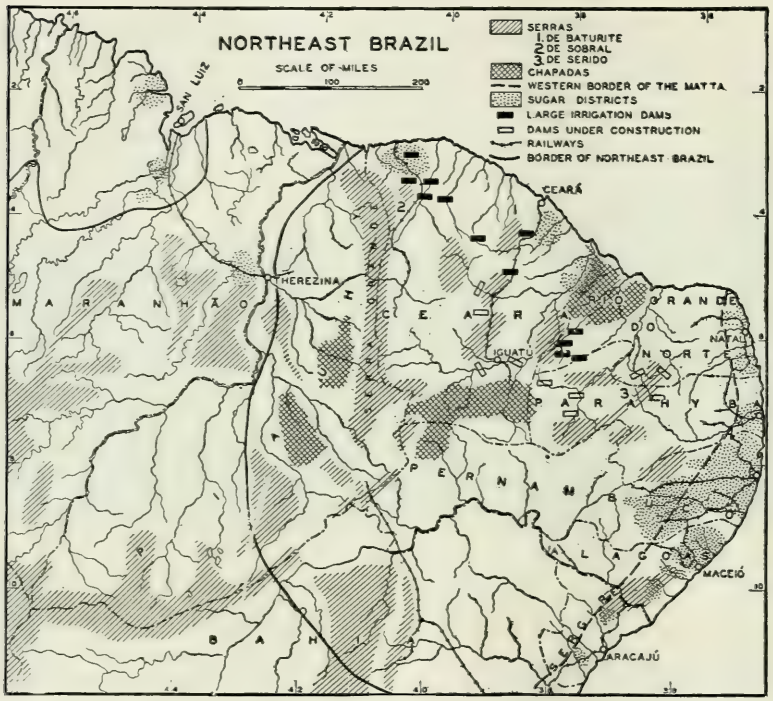

FIG. 210

The significant relief features of Northeast Brazil include the low coastal zone, belonging to the *matta*, the *chapadas*, basin-like or piedmont areas at the base of the *serras*. (Relief features and irrigation after Brazil, International Map of the World, Berlin Lithographical Institute, 1922, 50 sheets, scale 1:1,000,000 and R. Crandall.)

distributing point for most of the region. Fourth among the cities of Brazil, it has important industries devoted to sugar-refining, tobacco, and cotton textiles. Other than Recife, Northeast Brazil has no great centers. Each state has one principal port, of which Fortaleza (Ceará) with 80,000 people is the largest (Fig. 210). Coastwise steamers carry on a brisk trade between Recife and each of these smaller shipping points.

THE PHYSICAL CONDITIONS

The physical landscape of Northeast Brazil consists of three major divisions: marginal lowlands, forested in part, with relative abundance of rainfall; *sertão*, parched uplands of brushwood and grasses interspersed with patches of hard-leaved *caatinga*; *serra*, elevated mountain zones, islands of comparatively luxuriant tropical vegetation and supporting advanced agricultural districts. For most of the region in the interior, drought is a menace, the likelihood of which is a constant preoccupation for the inhabitant. Life is precarious. Indeed, owing to the high density of population, the *sertão* constitutes one of the important famine zones of the world.

Topography and Soils.—The moderate relief of the coastal lands has served to promote agricultural development. Inland from the groves of coconut palms which stud the dunes near the strand, stretches a low coastal plain, the sandy soils of which produce much cane. On the west this grades into the sugar zone *par excellence*—the *matta*. Having young red soils, deep and fertile, derived from the crystalline rocks of the interior plateau under protection of a forest cover, the *matta* markedly favors cultivation of sugar cane. The plantations cover alluvial deposits in the valleys and also attain the lower slopes of the rolling hills. At its inner margin, lying at 30 to 50 miles from the coast, the *matta* gives way to the higher drier territory of the *agreste*, a land devoted in the main to pastoral industries. The cotton fields characterize lands in both *matta* and *agreste*.

Rising to a maximum elevation of somewhat over 3,000 feet in the east, the plateau of Northeast Brazil for the greater part has the characteristic peneplain landscape, though prominent interruptions exist, indicated generally by a distinct form of agricultural activity. In various higher districts, horizontal layers of sandstones and limestones underlie the surface, the porosity of which accentuates the aridity of the land. The region has undergone heavy denudation, as a consequence of the scant cover of vegetation and the torrential character of the rains, so that in rather extensive tracts outcropping bedrock diminishes the utility of the land.

The granitic *serras* in isolated monadnock peaks or in extended massifs constitute veritable oases when their height proves sufficient to give them greater rainfall. The two principal ranges, Serra de

Baturité and Serra do Sobral, both situated near the coast, seem regions of limitless wealth in comparison with the encompassing barren *sertão* (Fig. 211). Here sufficient water is obtained to raise, in cases without irrigation, frequent crops of coffee on the slopes and sugar in the valley bottoms. Naturally, the heights soon became overpopulated, their forests destroyed, and their soils exhausted and badly eroded.

The rivers of the region contribute to the difficulties of maintaining steady agricultural production, aside from their lack of navigability.

FIG. 211. PLATEAU OF WEST PARAHYBA, BRAZIL

The old erosion surface of the *sertão* stretches as far as the eye can see; in the center of the picture sleeps the small town of Soledade, subsisting on grazing and a little agriculture. (*Courtesy of C. F. Marbut.*)

While their courses across the resistant ridges and at the margins of the crystalline area provide narrow gorges adapted to the construction of dams, blocking of the streams to secure more reliable supplies of water involves flooding of the agricultural lands concentrated in the valleys.

Climate.—Differences in climate account both for the several industries of Northeast Brazil and for the interdependence which these have developed.

Much of the eastern coast, north to the state of Parahyba, enjoys the benefits of rainfall favorable in quantity as well as distribution and of elevated temperatures. Ordinarily, the régime of rains differs considerably from that of the semi-arid grazing lands of the interior, although the higher *agreste*, devoted largely to cotton, partakes some-

what of the character peculiar to the inland plateaus. These western areas receive between 30 and 40 inches of rain annually, the maximum occurring in the period December to March inclusive. As in the *sertão* of the adjacent region, prolonged drought may emphasize the dry season ushered in during the interval about the autumnal equinox. On the other hand, the *matta* in general has an annual quota of some 40 to more than 60 inches of rain which falls principally between March and August. The dry season, though distinct, involves no great aridity. Sugar cane culture near the coast denotes the adequacy of *matta* rains, cotton in the interior the hot arid periods of the uplands. So sharp is the distinction between the two zones, that laborers who gather cotton in the *sertão* in the months beginning with July—following the rainy season—are free to undertake the major harvest of the *matta* which begins some three months later—at the end of the rains of the latter district.

To the west of the states Sergipe, Alagoas, Pernambuco, Parahyba, and Rio Grande do Norte, much of the region receives an annual rainfall greater than that for most of the Pampa; a maximum rainfall of 60 inches annually occurs on the coast in the vicinity of Fortaleza, and in isolated mountain zones of the *serras*. In contrast less than 30 inches fall in the area to the immediate north of the great bend of the São Francisco River. However, high temperatures arising from low latitude and disposition of topography greatly minimize the effectiveness of the precipitation. In addition, precipitation is irregular and uncertain. Areas in the state of Ceará which may receive more than 20 inches of rain in one season (March, April, May), in a corresponding period a few months later (September, October, November) suffer from marked aridity with less than 2 inches. In the southern part of the region June, July, and August signify drought months also; moreover, the precipitation of the short wet season comes in heavy rains of limited extent.

The coming of the rains gives the parched country an entirely new aspect. Relatively rich soils and elevated temperatures stimulate rapid growth. Herds become fat and sleek. The region prospers. On the other hand, should the anxiously awaited rainy season, which begins ordinarily in January, fail to materialize, the land faces the prospect of a wretched year. Then, the same temperatures and the intensity of evaporation, favored also by the southeasterly trades at

the summer season, wither all life. Vegetation adopts all of the xerophytic adaptations at its command; livestock, less favored, seeks water and, finding none, in many years perishes; then man engages in a veritable exodus to other lands.

Such migration from the *sertão* have peopled other districts of Brazil, especially the Amazon basin, and have reached huge proportions. Of the long series of memorable droughts between 1792 and 1914–1915,[1] that of 1877–1879 cost the region practically all of its livestock, and in the year 1878 alone 54,000 inhabitants left Ceará. Estimates of even normal annual emigration for the region reach 15,000 to 20,000. The only practicable remedy directed at diminishing the effects of drought lies in the extension of irrigation works, but the region is large, communications difficult, and money lacking.

Vegetation.—In the light of difficulties faced by the early settler in penetrating the heavy forests of other areas of Brazil, the low flat coasts of this region readily lent themselves to development. In much of the eastern states forests lay on a rolling surface of fertile soils; in Ceará and Rio Grande do Norte the land bore only a meagre stand of scrubby trees and grasses. To the sugar and cotton areas of the east, the natural vegetation represented a feature to be removed in order to till the rich soil. In most of the interior, the plant life was conserved to maintain the principal industry.

Covering the vast extent of the interior *sertão*, the *caatinga* provides the basis for the rearing of livestock (Fig. 212). A dense brush, which varies considerably in aspect from season to season, becomes sere and desolate in appearance during the dry season, while at the time of the rains it acquires foliage and quickly takes the form of a green forest. The *caatinga* includes especially numerous *Mimosae*, the trees generally stunted and thorny, several *Bombacaceae*, the rubber-producing *maniçoba* (*Manihot glaziovii*) and various cacti. Arborescent forms may disappear, particularly in the barren granites of the Borborema Plateau at the east of the region in Parahyba, Rio Grande do Norte, and in the more arid lands of the São Francisco trough. In such places cacti predominate. During the season of rains, various herbaceous growths spring up under the trees. In the moister alluvial plains of the coastal streams, principally that of the Jaguaribe River,

[1] Memorable droughts occurred in the following years: 1792, 1808–1809, 1816–1817, 1824–1825, 1844–1845, 1877–1879, 1888–1889, 1902–1903, and 1914–1915.

the valuable carnauba palm occurs.[2] The most luxuriant expression of natural vegetation belongs to certain of the *serra* heights, where orchid, palm, and other forms of the evergreen tropical rain forest abound. Such areas at present comprise only tiny fragments of the original cover; their wealth was too great to permit perpetuation. Although, following clearing, the tramping by the herds hinders

FIG. 212. CAATINGA, NORTHEAST BRAZIL

A typical view of the dry forest of Northeast Brazil at the end of the dry season when all grasses have withered and the trees are bare; during the rainy season the vegetation assumes a verdant aspect; much of the region has more cacti; near Soledade, western Parahyba. (*Courtesy of C. F. Marbut.*)

natural reforestation, considerable tracts have produced a new growth in which large arborescent forms yet predominate.

AGRICULTURE

Agriculture in the Eastern Cotton and Sugar Lands.—The region's long dependence upon sugar and cotton has prevented the development of certain elements of a balanced economy. Nevertheless, for some time no dangerous situation can arise, for the products find a large domestic market. If the region were dependent upon foreign commerce its agriculture long since would have undergone profound modifications.

Although 7,000,000 people, with relatively low purchasing power,

[2] A stately tall tree, the carnauba palm constitutes a leading natural resource. It has a great variety of uses in which are employed roots, sap, trunks, fruit, leaves, and particularly the fine vegetable wax.

live in the region, more than half of the 1,250,000 acres of cultivated land is devoted to two industrial crops. The less directly utilizable of the two—cotton—occupies alone one-third of the total acreage. Owing to the long-established trade with the *sertão*, how-

FIG. 213

Brazil possesses two areas of significant cotton acreage; the northeast in the *matta* zone and basin-like *chapadas*, and in the rolling plateau lands of São Paulo.

ever, the apparent paucity of a subsistence agriculture is less significant, for thousands of cattle are driven to the *matta* zone each year. In addition the productivity of corn, cassava, and beans diminishes possible perils of over-specialization in cotton and sugar. In addition, the tropical luxuriance favors cultivation of many lesser crops, such as tobacco, coconuts, castor beans, and cacao. Swine and sheep supplement the beef diet.

Cotton.—Cotton was among the first crops to become important in Brazil and has played a part in the agriculture of Northeast Brazil since the early colonial days. Produced largely in Pernambuco and Parahyba, it constitutes the principal export of the area and because of its excellence and the expanding Brazilian markets promises to continue so (Fig. 213).

Differences in physical conditions cause the region to grow two distinct types of cotton—*matta* and *sertão*. The first kind produces a short coarse fiber of great strength and characterizes the eastern lands of heavier rainfall. Ordinarily an annual, the plant may yield one ratoon crop. *Sertão* cotton is superior to that of the *matta* in most respects, but in point of annual yield the latter excels. The upland type is a perennial tree variety and produces a long and strong silky fiber. On occasion it may remain in the field for as much as 5 years.

In the primitive way which has prevailed for centuries, the crop is produced chiefly on small farms. Devoting little time to breaking the ground, the cultivator plants his fields by seeding among the débris remaining after the forest growth has been burned. As a rule, he grows crops of corn, beans, or cassava, among the rows of cotton plants. However large and abundant, weeds are ignored. This general indifference to careful means of production becomes all too evident in the baled product as well. Though the constant progress of the southern cotton areas in São Paulo points to a continued withdrawal of markets for the north, on the other hand, an immediate market of 7,000,000 people suggests a prosperous future for the cotton mills of Recife, a feature in turn indicating the likelihood of refinement in raw materials.

Sugar.—While taking but five-eighths as much land as cotton, sugar contributes far more to the sustenance of the inhabitants (Fig. 214). This crop, too, has had a long history in the region, for the colonial settlers quickly realized the opportunities for the export of sugar. Eventually this interest led to the peopling of the lands about Recife by the element now preponderating—the negro—descendant of the numerous slaves laboring on the nineteenth century plantations.

Because of the fertility of the soils in the lowlands extending across the *matta* the growth of cane acreage was rapid principally in the southern states. In Parahyba and Rio Grande do Norte the length of the dry season and the generally smaller annual rainfall result in a

general small acreage of cane. Cultural methods on the whole resemble those in vogue for cotton, each sugar mill drawing upon a number of small cane fields tended by share farmers. Modernization of cultivation proves next to impossible, life being far too easy for the laborers. Moreover, the factories lack good equipment, although their numbers and size enable the manufacture of more than half the sugar produced in Brazil. In contrast to cotton, virtually none of the

FIG. 214

More widely distributed than cotton, three major areas of sugar culture stand out; the *matta* zone of the northeast, the rolling lands of eastern Minas Geraes, and the alluvial lands of the *Campos* of northern Rio de Janeiro. Since colonial days it has dominated agriculture in the *matta* zone.

sugar goes to foreign markets. Other regions of Brazil purchase large quantities and within the area the sweet to a considerable degree supplements the diet of vegetables and grain.

Agriculture in Sertão and Serra.—The west produces a number of agricultural commodities, both for export and to supply its own comparatively large population. Because of the several differences in physical character, the life of the *sertão* contrasts markedly with that of the *serra*. As a whole, the former is distinctly the land of the grazier, crops with the exception of cotton becoming significant only

in supplying the laborers for the individual cattle *fazendas*, and the fields are protected against the animals; locally, however, restricted areas of moist land become crop areas. Cattle and goats occupy the time of the inhabitant of the *sertão*. The people of the *serra* cultivate the land. Here, by corrals or by tethering, the few animals are kept from the fields of cotton, sugar, tobacco, coffee, and less important cash products. In all parts of the region, cassava, corn, and beans complement the meat and milk diet of the population. A third class of products, obtained essentially from the native vegetation, comprise the carnauba and rubber-yielding forms. It belongs properly to *sertão* activities.

Contrasts between *sertão* and *serra* become especially prominent during periods of drought, for with the first premonitions of a poor year, movement sets in from the grazing lands towards the mountains. Although this leads to overpeopling of the *serra*, since available transportation facilities can hardly cope with the problems of carrying foodstuffs to all districts, it represents the only possible means of self-preservation for the inhabitant of the *sertão*.

The 3,000,000 cattle of the *sertão* form the basis for the principal industry. Hardy, scrubby animals in which the zebu strain is prominent, they graze over the meagre growths of the *caatinga*, as has continued for several centuries. Cattle estates embrace vast areas, each an independent unit also producing so far as possible its food crops. The characteristic cowhand, or *vaqueiro*, a regionally peculiar nomadic type of principally Indian blood, rarely cultivates the land. Instead, small colonies of permanent settlers work during the rainy season to produce a few crops for the ranch.

Methods of utilization differing quite prominently from those in vogue in southern Brazil or in Argentina, the animals reach marketable age at 4 years, when they are sold at the numerous fairs held throughout the year in various districts of the *sertão*. Few cattle remain in the *sertão* for use by the producers. This results from the sparse population in the grazing areas proper and its preference for a dairy diet. The people prepare quantities of milk and cheese for local consumption. Approximately one-third of the animals reach the abattoirs of Fortaleza, an equal portion supplies the densely populated lands of the *serras*, and the remainder travel on foot to the coast to embark for Pará; hides furnish a leading export of the region.

The wide variations in numbers of cattle from year to year indicate the major problem of the livestock industry, water supply. More than 40 reservoirs have been built to mitigate the effects of drought in certain areas, but as a whole the region lacks adequate water in the

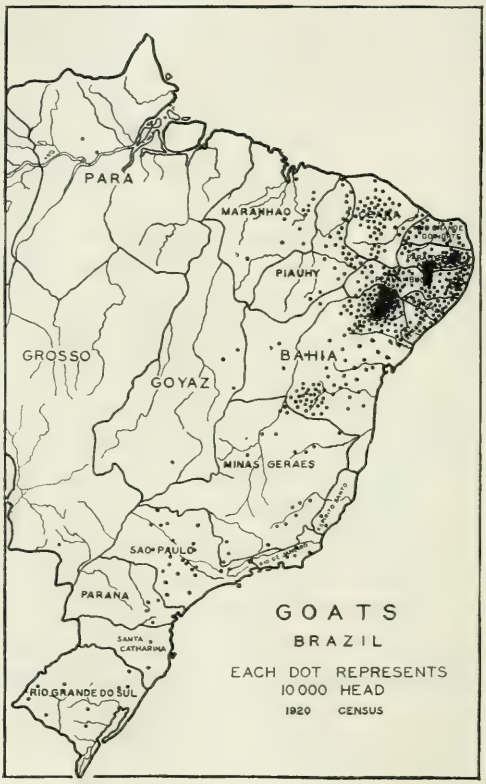

FIG. 215

Nearly all the goats of Brazil pick a precarious living from the arid vegetation of *sertão* in Northeast Brazil; they supply subsistence for many families of meagre resources.

dry season. With the close of the rainy season, the surface waters are gradually exhausted and as the year progresses the work of the *vaqueiro* becomes more difficult. Then digging of wells in every likely spot begins. Exhaustion of the grasses also makes necessary rations of fodder, provided generally by the leaves of the *Mimosae*, the leaves of which precede the rains, and by cacti stripped of spines.

Adapted to these semi-arid lands far more than cattle, goats graze

over most of the region (Fig. 215). They total some 3,000,000 animals and the goat industry of this region is a major source of goatskins in international trade.

Although grazing dominates agricultural life in the *sertão* proper, in the aggregate, crop cultivation on two classes of producing lands plays a considerable part in supporting the region. In one kind of land, the *roçado*, clearings in the brush are encircled by a protective fence and planted to various crops immediately after the first rains. Low moist lands, *vasantes*, compose a second group. Here crops may not be realized every year. Drought ruins especially the prospects of the *roçado;* while should heavy rains occur, flood may destroy the crop of the lowland *vasantes*, for these often occupy the river flood-plains.

Grains, cassava, and cotton are the principal crops. The only crop regularly exported from these lands, cotton has had a varied evolution in the region. As was the case in other parts of South America, it sprang into importance at the time of the Civil War in the United States. With good rains the crop throve, securing especial benefit from the pronounced dry season, but recovery of the American industry and the growth of new areas in Brazil reduced the prosperity of that in the *sertão*. The crop still persists to the extent of almost 100,000 acres, produced largely in the state of Ceará, which ranks fourth among the states of Brazil in acreage of cotton. The common method comprises independent production on a small scale by those who cultivate crops for the cattle estates, tree-cotton of high quality being the usual type. With the growing assurance of irrigating waters provided by numerous dams under construction, the crop will become increasingly important in the region. Among the richest zones of the *sertão* is that called the *Serido*, situated on the western slopes of the plateau of Borborema. Here several hundred small diversion dams transform one of the driest sections of the region into a rich district producing an abundance of crops.

Of the few native plant industries, that of the carnauba palm possesses first importance. Drought-resistant and relatively numerous in the coastal areas, the tree yields a number of products, edible as well as inedible, the most valuable of which—a wax—is exported in considerable quantities. Shortage and inefficiency of labor hinder expansion in the industry. Unimportant exploitation of two rubber-producing plants has added in a small way to the list of exports.

The *serra* zones show characteristics peculiar to desert oases. They are small havens of refuge in time of drought and producers of important cultivated crops for the entire area. Cultivation of land dominates and the life of the inhabitants differs broadly from that of

FIG. 216. PERENNIAL TREE COTTON

Producing year after year with little care, though badly mixed and dirty, tree cotton of long silky fiber supplies the chief cash crop of many districts of arid Northeast Brazil; valley of Serido River south of Jardim do Serido. (*Courtesy of C. F. Marbut.*)

the breeders of livestock. On the whole the peoples of the *serra* send little directly to those of the *sertão*, the population of the grazing land generally going instead to the mountains for the commodities required, which comprise chiefly sugar, alcohol, and coffee. Little commerce in primary plant foodstuffs exists, for each zone proves sufficient to itself during normal years in grains, cassava, and beans.

Although the land has numerous crops obtained as a consequence

of the favorable physical condition, cotton holds first rank as a cash crop (Fig. 216). Several factors, however, hamper extension of its cultivation: lack of labor and capital, negligent methods of production and marketing, and the ravages of the boll weevil, in addition to the constant possibility of prolonged drought.

With sugar the *serra* effects closest relations with the *sertão*. Practically none is exported outside of the region but in the form of concentrates, syrup, rum, or alcohol, the crop goes to all parts of the

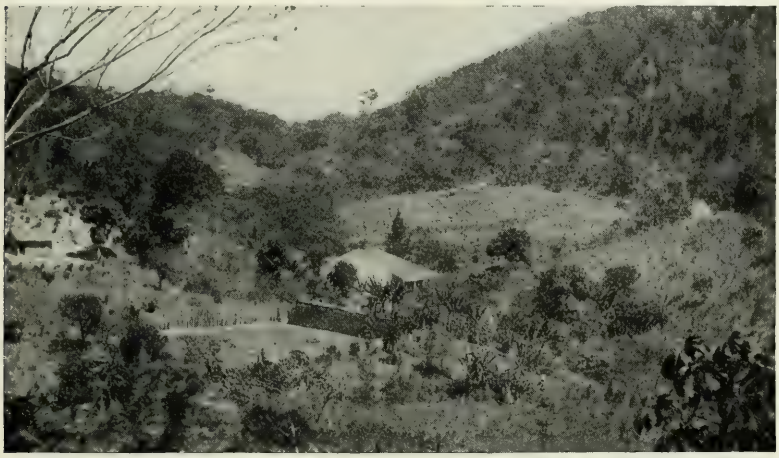

FIG. 217. SERRA DE BATURITÉ, NORTHERN CEARÁ

By reason of greater elevation and exposure the *serras*, able to wring more moisture from the atmosphere, support a more forest-like vegetation than the *sertão*, grow a variety of crops and have many more people per unit of area; they are havens of refuge for the people of the *sertão* when pastures and crops of these arid stretches give out. (*Courtesy of C. F. Marbut.*)

region. Before the notable drought of 1877–1879, it constituted the basis for an era of great prosperity in Ceará. Then paucity of slave labor, in comparison with the situation in other parts of Brazil, brought about the eventual decadence of the industry. The drought materially hastened the decline. Nevertheless, with 60,000 acres it has great importance in the diet of the region. The major concentration lies in southern Ceará, where the springs of the Chapada do Araripe favor its cultivation.

The second crop of the *serra* destined to leave the mountain slopes for distribution among the inhabitants of the *sertão* is coffee (Fig. 217). Though only 30,000 acres are devoted to the crop, principally

in the Serra de Baturité, it is important, for to the native coffee constitutes as vital a necessity as *yerba maté* to the peoples of the Paraná basin. The trees occupy the slopes above the cane, and as with all crops, its production from year to year shows wide fluctuations.

MINERAL INDUSTRIES

Though Northeast Brazil has considerable resources in precious metals and stones, copper, wolframite, and oil shales, mineral exploitation is comparatively unimportant. In only two districts has a regularly active industry developed, both of them producing salt. In Rio Grande do Norte, Brazil secures most of its salt by evaporating ocean water or that of partially enclosed lagoons. Natal, the leading city of the state, and Macau have considerable salt-refining industries, most of the product going to the livestock industries of other states. Salt also comes from Rio São Francisco waters near Joazeiro.

THE PROSPECT

The major occupations of the present day have dominated human economy in Northeast Brazil since early settlement. With little doubt, the region will continue to exhibit the features of industries now prevailing.

In the eastern states, physical conditions so fit the requirements of both cotton and sugar, the former in the drier west and north, the latter in the moister zone near the coast, that population has evinced little interest or aptitude for other cash crops. The size of easily reached markets contributes to the advantages of this section. Hence, notwithstanding possibly adverse eventualities, cotton and sugar will retain premier rank among the crops.

Developments in the lands of the Central Plateau of Eastern Brazil in particular conflict with the potential prosperity of the northeastern cotton and sugar industries. Both crops find a favorable place in the southern region. Proximity of the bulk of Brazilian population and a better developed rail service augment the superiorities of the plateau lands in São Paulo and Minas Geraes. Paucity of rolling stock in the vicinity of Pernambuco has frequently hampered the marketing of produce.

The machinery of improvement accompanying investment of

foreign capital and succeeding the experience gained in competitive marketing already gathers momentum. Grading of cotton and careful handling of sugar have started. A permanent retention of present significance, however, entails considerable more perfection of technique than now in immediate prospect. Nevertheless, the ordinary rural inhabitant has little to fear. His needs are few, his ambition limited, his fields productive. It is rather to the influence of Recife that cotton and sugar will owe whatever development may come.

As for the western semi-arid lands of Northeast Brazil, the principal necessity involves a minimizing of drought perils. The Brazilian government has undertaken an extensive program of irrigation and inculcation of dry-farming methods, but the area covers a vast expanse. Expansion of railroads and motor roads can further production in the region likewise, both in effecting better facilities for exchange between *sertão* and *serra* and in permitting rapid land communication with the rich coastal lands of the east. Widespread improvement of agricultural conditions remains an accomplishment of the distant future. This dry land produces few commodities enriching the country as a whole. Despite its population and relative proximity to centers such as Bahia and Recife, it suffers from isolation; it holds little lure for the European immigrant. Moreover, the far more productive lands of southeastern Brazil have a better claim upon funds destined to the development of natural resources. As a result *sertão* and *serra* will continue in mutual dependence and to a great degree in combined self-sufficiency during favorable periods.

CHAPTER XXXIV

THE CAMPOS OF CENTRAL BRAZIL

As the largest relatively unutilized, though fairly promising grazing territory of the world, the great interior grasslands of Brazil have a notable significance. As yet, however, their far-flung expanse in no one district experiences present development of any great consequence. Parts of Amazonia, or of the Chaco, have evolved a far more productive exploitation of resources. To be sure, the mineral wealth in certain districts has attracted much attention, but the areas involved are small and most of the enterprises have simply flared up for a time, only to sink into obscurity. Why this should hold depends almost wholly on the inadequacy of transportation facilities.

The principal grazing areas lie at considerable distances from the sea; owing to the hugeness of the region the grazing areas can scarcely justify extension of suitable rail services in the light of needs arising in more productive districts. Though a major outlet utilizes the Paraguay River, fluvial carriage can do little to aid further progress. From Corumbá, the principal shipping point of the central Campos, the journey down-stream is slow, tedious, and a long one for cattle. Buenos Aires lies 1,422 miles distant. To the north a number of streams flow to the mighty Amazon, but none offer means of communication of significance since all are interrupted by series of falls and rapids through long stretches where they descend from the older sediments to the less-resistant recent deposits of Amazonia. On the east two rail lines touch the region; one into southern Goyaz, and the other across Matto Grosso to Corumbá; but neither affords feasible outlets for much freight owing to long expensive hauls to the sea. Farther north a possible outlet overland and down the valley of the Rio São Francisco is scarcely used for contacts of any kind with the Atlantic seaboard. Far away and isolated much of the Campos remains an unknown land even to Brazilians in Rio de Janeiro and São Paulo (Fig. 218).

The sparse population reflects further both the isolation and the

leading industry. Gained only with hardship, the interior averages less than one inhabitant per square mile composed chiefly of indigenous Indian groups. Vast areas have only roving bands of nomadic Indians, who wander whither they listeth gathering sustenance from field and animal life and being sheltered from the elements by little or no apparel and a crudely constructed brush hut. Much of the Amazon Basin supports far more people per unit of area. A few men

Fig. 218. Highway, Tavares to Goyaz City

One of the great handicaps of the vast Campos consists of inadequate transport facilities; the bridge on this main highway illustrates the backwardness of even the most advanced portion of the Campos. As long as isolation dominates, the fruit of range and farm cannot reach outside markets. (*Courtesy of Ernest G. Holt.*)

can guide large herds, and the comparatively unimportant forest enterprises are carried on in sporadic fashion. Hence communities attain only diminutive proportions, the largest—Corumbá—serving a hinterland larger than the Pampa and containing less than 20,000 people.

Original peopling by Europeans came by way of expeditions raiding interior Brazil for slaves. The early discovery of gold near Cuyabá, at the headwaters of the Paraguay River, determined the first settlements. The scattered occurrence of deposits led miners to many parts of the land. Later diamonds added to the mineral wealth produced

in the region. None of these enterprises retained widespread importance and the raising of cattle became the dominant industry.

Climate.—Over a latitudinal extent of more than 20 degrees, a distinct winter dry season characterizes the area as a whole. Except for the drought of June, July, and August, tropical rain forest rather than Campos might clothe much of the far-flung plateaus. In contrast to the exceptional lack of precipitation during the winter, summer brings singularly heavy rains. Cuyabá, located in the basin of the upper Paraguay, receives nine-tenths of an inch of rain in the quarter, June—July—August, but 28.4 inches in the period, December—January—February, much of the latter falling in violent thunderstorms. Such unequal distribution of heavy rainfall through the year conduces to the growth of a tropical savanna.

Particularly in the higher east somewhat variable temperatures over much of the land favor human occupancy, diurnal variations exceeding 40° F. Especially in winter, when the reduced relative humidity permits intense nocturnal radiation, the minima may touch unusually low levels. The low latitudes and, in cases, the low elevation occasion also high day temperatures, maxima attaining 105° F.

Topography.—The plateau serves to illustrate agriculture in the region as a whole, but various differences exist both in topographic physiognomy and in consequent human response, for in its reach from Andean foothills to Serra do Mar the Campos Region embraces several physiographic provinces.

Westward from the margins of the Paraguay River far to eastern Bolivia extend the low, flat, alluvial lands of interior South America. These frequently marshy lands support a large part of the cattle of the region, principally in the districts bordering the streams. Grazing has found a noteworthy advantage over that on the plateau because of its proximity to the great river highway. Eastward the great plateaus of Matto Grosso and Goyaz dominate the region (Fig. 219).

The uplands of Matto Grosso, which average an elevation of some 1,600 to 2,500 feet, consist mainly of broad flat-topped areas rising above the less uniform districts which characterize also the lands to the east. Known as *chapadas*, these level expanses are potential cattle lands of considerable importance. Produced by sandstones,

they possess soils inferior to those found on the crystalline areas, such as the peneplain of south Goyaz.

In addition to alluvia and the *chapadas* occupying one-third or more of the region, the east has crystalline peneplains in Goyaz and in the basin of the São Francisco River. These contain the richest lands of the Campos Region. The heavily forested Serra do Paranán separates the two portions of this province; it reaches a maximum elevation of 5,000 feet and constitutes a part of the *chapadas*.

Fig. 219. Rolling Plateau Land of the Eastern Campos

The higher portions of the Campos and the stretches along the streams in general support the denser growths of vegetation; basins or broad valleys are covered with tall savanna grasses, areas of considerable potential value for grazing; on the hill slope the cleared patch is planted to corn. (*Courtesy of C. F. Marbut.*)

Vegetation.—Although the vast expanse of Campos vegetation which gives character to the region as a whole covers some two-thirds of the area, forests represent an important element of the natural vegetation, in moister river valleys and on elevated districts having more uniform distribution of rains.

The Campos in general comprises a savanna formation over which rather widely scattered, stunted, arborescent forms rise above a cover of grasses, herbaceous plants, and shrubs. A notable alteration of aspect occurs between rainy season and dry season. With the cessation of rains the whole savanna becomes a parched and desolate realm, the grasses losing succulence quickly and becoming harsh and unpalatable to the livestock. The natives resort then to fires in

order to obtain a growth of nutritious grasses. The impracticability of providing prepared fodder seriously hinders the pastoral industry. With the onset of the rains the land changes into a flowery luxuriance of green vegetation.

Two types of vegetation characterize the region: *campo cerrado* and *campo limpo*. The former endows the sandstone as well as the crystalline plateaus with a savanna of hard scanty growth of grasses interspersed with various trees, some of which have economic value. In contrast the *campo limpo* occurring in physically droughty soils supports no tree growth. It covers a relatively small area.

In all parts of the region, gallery forests mark the stream courses; but in certain sections, such as large portions of Minas Geraes, conditions of underground water may permit an extensive stand of trees. Towards northwest and southeast, differences in rains permit the natural vegetation to assume gradually the aspect of Amazonian forests and of those of southeastern Brazil respectively. In the northeast, the *campo cerrado* gives way to characteristic growths of the more xerophytic *caatinga* peculiar to most of Northeast Brazil and to much of the São Francisco districts. The few principal forest industries include gathering of rubber yielded by species of *Hevea* and *Castilloa*, as well as the *mangabeira* (*Haneornia speciosa*).

The great marshes of the upper Paraguay and those adjacent to eastern Bolivia constitute an additional element in the vegetal complex, those of the former especially favoring the pastoral industry, as shown in the concentration of cattle about Corumbá and Cuyabá.

THE CAMPOS GRAZING INDUSTRY

Over these great interior grasslands, cattle grazing is easily the major occupation. Although the industry suffers under the weight of many handicaps, the few natural advantages combined with the effects of various hindrances indicate its long-continued dominance as a human activity in the region.

The millions of cattle grazing the lands are grouped in many parts of the region, but much territory remains untouched and a considerable portion can support not even a rudimentary utilization of its resources (Fig. 220). The principal districts lie about the plains adjacent to the Paraguay River and in the more healthful uplands of southern Goyaz.

Now numbering 5,000,000 head, the industry of the Paraguay district had an early start. The ranches first arose in response to the needs of the gold and diamond mining enterprises, early dominating exploitations of the district, and took the higher lands about the alluvial plains. Later the attractiveness of the water meadows, de-

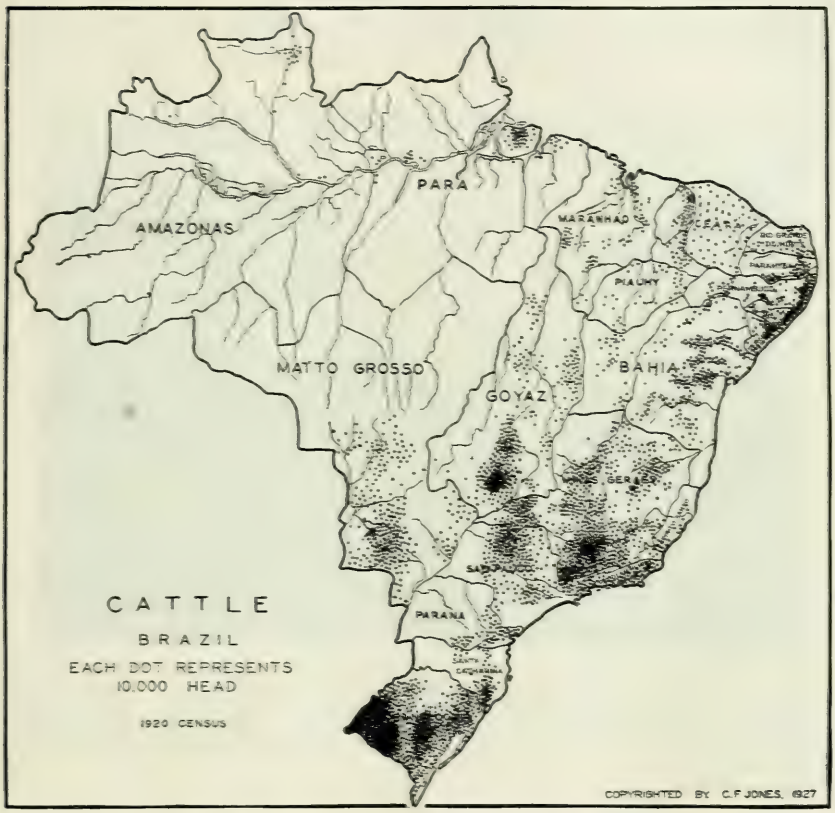

Fig. 220. Distribution of Cattle in Brazil

spite flood dangers, drew the herds to the river. Here care of herds proves difficult, owing to nature of terrain and problems of raising horses in the humid areas, but location near the river means access to transportation facilities.

Goyaz and Minas Geraes, which also produced cattle for the miners, now graze more animals than the western district, and bear promise of considerable development. The climate favors both man and ani-

mals to a greater extent than farther in the interior and rail connections of some utility contribute an additional advantage.

Herds average large and of poor quality. Wide of horn, bony of frame, and difficult to fatten, the cattle serve only to produce hides and jerked beef. While various attempts have been made to improve the general type, principally by the introduction of zebu cattle, they have effected little wholesale raising of standards as yet. In comparison with such favored areas as southern and east-central Brazil,

FIG. 221. CATTLE PEN AT GOIABIERAS, GOYAZ

Before the Campos can become an important producer of cattle products for foreign lands the old native stock mixed with zebu blood must be changed to a higher grade animal by the introduction of enormous numbers of pure-bred animals. (*Courtesy of Ernest G. Holt.*)

not to mention the Pampa, the difficulties of production prevent the investment of much capital in the importation of pure-bred stock. Open range grazing increases immensely the problems of careful breeding, and the illiterate and nomadic native population displays little interest in the possibilities of obtaining better herds.

In view of such factors, grazing in the Campos Region is of importance rather as a potential resource when pressure of crops or pasture lands becomes sufficiently great in other parts of the world. At present physical and economic disadvantages are so great that little can

be accomplished for scores of years. It is true that capacious savannas in part possess fairly nutritious grasses and normally dependable water supplies, but over large areas they contend with a long list of detrimental factors. Isolation is a major deterrent; the grasses are harsh and necessitate frequent burnings; tick, plus hoof-and-mouth disease, take enormous toll in quality and numbers; drought exercises a similar influence. Such features long will keep the herds of the Campos in a mediocre state of development (Fig. 221).

FIG. 222. ENTIRE FEMALE POPULATION, CAPÃO DE CANOA, GOYAZ

Though much of the population of the Campos consists of backward Indian folk, a strong strain of negro blood brought in during the gold and diamond mining days has increased until today negroes constitute the total population of many settlements in the region. (*Courtesy of Ernest G. Holt.*)

DIAMONDS

In value of exports, diamonds are a leading mineral product of Brazil. In most years considerably more than a million dollars in the gems leaves the country. Most of the industry lies at the eastern margins of the region, in northeastern Minas Geraes in the drainage basin of the Jequitinhonya River about Diamantina and in southeastern Bahia about Lencoes. The latter is the more important and depends chiefly on *carbonados*, or black diamonds. Workings utilize almost exclusively the loose alluvial sands in the river channels or

flood-plains. A long duration of the industry is promised owing to the numerous deposits found not only in the foregoing districts but also in Goyaz and Matto Grosso.

The announcement by a priest, in the early eighteenth century, that diamonds existed about the gold washings of Minas Geraes caused the first feverish search for the brilliants. By 1732, 40,000 men were engaged in the diamond industry. Large villages of slaves who worked the deposits under a crown monopoly appeared and operations proceeded under the surveillance of troops. Rio de Janeiro owes its rise to early supremacy in large part to the flood of wealth and men engaged in the diamond traffic. For a century and a half Brazil led the world in the production of diamonds. Exhaustion of richer sources and the opening of the far more productive developments in South Africa led to the comparative decadence of the industry, although it still employs some 10,000 men (Fig. 222).

Inferior in so many respects to the productive capacities of better situated lands, the Campos Region in its entirety can undergo little material progress in the near future. Its major industry—grazing of cattle—suffers under handicaps of pastoral conditions and isolation too powerful to permit present-day utilization of resources to any marked extent. A large part of the continent will experience tremendous growth before these broad savannas can attain much development.

Before the Campos can undergo much advance, much of South America will have experienced a huge growth. This can be stated with considerable confidence, for the grazing of cattle—the region's major industry—labors under shackles of pastoral conditions and isolation too influential to allow early utilization of resources to any notable extent.

CHAPTER XXXV

AMAZONIA

The great Amazon basin of interior Brazil has had possibly the most colorful history of all the regions in South America. It has had also a long history since the primary attempts to exploit its resources. Nevertheless, today its expansive territory ranks among the least productive parts of the continent. Here a vast extent of land, surpassing in area Argentina or all of the United States east of the Mississippi River, yields as its major products only those commodities which are of extractive nature. Man has done little to modify his environment; rubber, nuts, timbers, and many provisions come directly from the forest. Primitiveness dominates; in few ways does human economy attest to premeditated effort on man's part to introduce large organized systems of development.

Despite its minor actual importance as reflected in dollars and cents, Amazonia throughout European occupation has held more of the world's attention than much of South America. This situation has resulted both from the wealth in various industries obtained from the forests and from the high regard for regional potentialities entertained by much of the world. None of the several countries sharing greater Amazonia evinces any desire to relinquish its holdings. Indeed, the problems of zones on contention in the Amazonian portions of several countries are among the most critical of present-day South America. Little is known of these disputed areas and their value remains highly debatable, but the possibilities ascribed to tropical lowlands make them prized possessions. Commercial developments to date indicate that Amazonia has enormous resources yet remaining in its forests, but as a producer of the major foodstuffs of the world in appreciable quantities, the region can undergo only a long slow evolution before it can achieve a permanent importance commensurate with its size.

The earliest settlements in the region penetrated the interior both from west and east. From Peru, Jesuit missionaries established posts

in the headwaters of the Amazon early in the sixteenth century. A more important movement came from the east, in the guise of Portuguese in search of slaves, gold, or gems. These latter found an abundant harvest of slaves about the Rio Negro and here accumulated the beginnings of population now centered in Manáos. Early development was exceedingly slow, owing to a failure to realize the opportunities of the forest, though no less to the superabundance of handicaps, many of which still deter progress in the region. Interest shifted from time to time, so that a kaleidoscopic economic evolution resulted. Coffee, sugar, cotton, and tobacco received considerable attention at one period or another. About Pará, which was founded in 1616, and near-by lands of the lower Amazon developed the principal centers of population and agriculture, as farther upstream, the agricultural and forest industries were supplemented by a considerable interest in fishing.

The boom in rubber and the spread of steam navigation in the later years of the nineteenth century initiated a striking change. People moved into the region in considerable numbers and comprised chiefly victims of the recurrent droughts in Ceará. Most of the immigrants sought the rubber lands and as a result the Amazon banks acquired their comparatively dense population. With reference to density of population resulting from the influx, the situation is not impressive; but these few people have played a vital part in the opening of Amazonia.

In the four centuries since its entrance on the stage of European activities, Brazilian Amazonia has managed to acquire approximately 1,500,000 inhabitants. Much more than half of these live near the Amazon below Manáos and along the Atlantic seaboard with access to the great water highways. In general, this population is a highly mixed one, estimates placing the number of mestizo Cearenses alone at one-third the total. The early Portuguese intermingled indiscriminately with the native Indian and further enhanced the mixture of races. The aboriginal Indians compose a small part of the total. Many of them live entirely outside of the Brazilian sphere of influence. Some are particularly savage, others tractable. All have developed only crude civilizations. A humid tropical climate not only relieves them of the problem of clothing, but supplies many kinds of food; and at the same time, their climate guarantees paucity

of population by the multitude of diseases it engenders. Closely linked to the rivers by the impenetrability of the forests, these peoples cling to the fruits of the river, the fish, for a staple article of daily diet. Contact with the white man has brought about profound changes. Less and less does the Indian or the half-breed depend upon his immediate environment for a complete living. Now he collects rubber or Brazil nuts, buys much of his food, and has lost much of his picturesqueness; but the connection with the rivers remains intact, a bond never to be severed.

The lands about the mouth of the Amazon have naturally become the scene of principal concentration of population. Pará, having a population of 250,000, is fifth among the cities of Brazil and long has been one of the chief cities of the country. It handles most of the trade for an enormous hinterland by way of the Amazon and its tributaries. In its quays mingle the products of all Brazilian Amazonia, the eastern lands of Bolivia, Peru, Ecuador, Colombia, and of much of the southern portions of the Guianan highlands. In addition, a considerable coastwise traffic utilizes the port facilities. Farther east, São Luiz de Maranhão supports 53,000, as a result of its access to the productive agricultural lands of Maranhão and to coastwise trade.

In the interior, one city controls practically all commerce. Fed by rubber, Brazil nuts, timbers, and a multitude of less important commodities, Manáos, at a distance of 1,000 miles from the sea, has 75,000 people and is the seaport for possibly 1,000,000 square miles of interior South America. Though the collapse of rubber dealt Manáos a terrific blow, the city's command of ocean-going navigation at the Amazon-Rio Negro juncture has given it a solid basis for growth. Many of the products descending the Madeira, Solimões (or upper Amazon), or Rio Negro now go direct from Manáos to foreign ports; formerly, transshipment at Pará ruled.

Without the magnificent system of navigable waters afforded by its rivers, the region would find its size fatal to exploitation. The Amazon is far and away the master stream of the world and its adaptability to navigation has been of prime importance in the development of Amazonia (Fig. 223). Brazilians call it the "Rio Mar"—"Sea River"—so majestic is its broad expanse of water. At Manáos, the minimum dry season depth is 40 feet. At Tabatinga, on the

Peruvian boundary 2,000 miles from the Atlantic, this great river has a width of almost 2 miles. The vastness of the region, however, diminishes the benefits of these advantages, the ordinary up-river voyage to Manáos requiring five to seven days. Such distances make for exceedingly high prices on imported articles, a matter of serious consequence to the interior in view of the high percentage of imported foodstuffs necessitated by the prevailing systems of exploitation and the small buying power of the population. Railroads have only a negligible importance. Amazonia has only a few hundred miles of

FIG. 223. AN OCEAN LINER AT MANÁOS

The great highway of the Amazon provides the only major outlet for a vast territory almost the size of half the United States of America; the steamer *Hildebrand* in the picture is taking on a load of Brazil nuts for the Christmas market in England; December 9, 1923. (*Courtesy of C. F. Marbut.*)

expensive line, the longest of which, that paralleling the rapids of the Madeira and Mamoré Rivers for 226 miles, finds operating costs too great to permit much growth in traffic.

PHYSICAL CHARACTER

A most notable feature is the uniformity of physical conditions. Briefly, the Amazon basin embraces a great area of comparatively little relief, forested almost entirely, and sweltering under the influence of a tropical humid climate. Embracing 1,800 miles in extent from north to south and 2,500 miles from west to east, practically all of the region has an elevation of less than 1,000 feet and easily one-half of this area lies under 500 feet. With a situation like that of the

central plains of North America, its lack of great relief would make the region one of the great producing areas of the world; but a true tropical climate, with its concomitants of rain forest, tropical soils, insects and diseases, gives Amazonia its predominantly backward aspect.

Climate.—Amazonia is the world's largest continuous territory having that climate most commonly associated with equatorial lati-

FIG. 224. PALM-THATCHED HUTS AT MONTE ALEGRE ON THE AMAZON

Steep and heavy thatched roofs as well as the luxuriant vegetation back of the huts indicate heavy precipitation which falls in the Amazon region; these huts represent the better type homes of the natives. (*Courtesy of Ernest G. Holt.*)

tudes. Throughout the year temperatures average high and daily range exceeds seasonal range so that night constitutes the winter of the land. At Manáos November has the highest mean monthly temperature with 81° F, March the lowest with 78° F. Such monotonous continuity of great warmth, coupled with high relative humidity, proves especially detrimental to human welfare. In his original state the native easily produces a sufficient store of foodstuffs with the result that apathetic indolence is a normal characteristic. Little need exists for the production of large quantities of supplies as a protection against possible famine in a poor season.

The rains have an important part in distinguishing the region from

neighboring areas (Fig. 224). Almost all of the land receives more than 60 inches per year, which comes generally in heavy downpours, the distribution of which accounts for the principal differences in climate and utilization of land among the various sections of the region. Conspicuously the wettest portion with annual totals approaching 125 inches is the far west, where practically every week brings drenching rains, though about the time of the June solstice a less rainy season holds sway. East of the Rio Negro-Amazon confluence, rains show a considerable decrease and the drier season from June to November brings sufficiently dry conditions to favor relatively large tracts of savanna rather than the tropical rain forest.

Vegetation.—For present-day purposes and as has been the case for centuries the vegetation of the region provides its most valuable natural resource. At the same time, the identical great tropical rain forests, because of their impenetrability are the major obstacle in the path of progressive development.

Covering almost all of the region, the forest mantle contains an astonishing number of species, with the more valuable of which the economic history of the Amazon Valley has been closely identified. Even with adequate means of transportation, exploitation proves difficult, for the trees grow in scattered fashion, the tangles of creepers and underbrush are exceedingly dense and the timbers have a specific gravity in many cases greater than that of water. In spite of all this great profits point to the long-continued dominance of forest industries in this region.

Aside from the distinction between the savannas of the north and that in eastern Marajó Island and the forest formation, the major groups of plants are divided on the basis of height above the rivers. About the mouths of the Amazon lie well-developed mangrove thickets giving way a short distance inland to a tidal lowland forest. Upstream, the alluvial plain in places has large tracts of grassland but westward particularly it supports a dense tree growth of medium height. This forest growth contains two of the most valuable trees of the region and of all South America, the *seringueira* (*Hevea brasiliensis*), the principal source of rubber, and the cacao (*Theobroma cacao*). Above the flood zone, the forest attains its greatest variety and possesses the important Brazil nut tree (*Bertholletia excelsa*) and the *caucho* (*Castilloa elastica*). The harder timbers also abound here.

Relief and Soils.—The vast lowlands composing the bulk of the region consist of three distinct types of terrain, all of gentle relief and in that respect suitable to the mechanical requirements of machine agriculture. The generally swampy alluvial districts include comparatively narrow strips along the rivers and comprise approximately one-tenth of the total area. Most of these lands have heavy dark soils of poor drainage, but in some districts highly productive well-drained loams border the river-banks. These latter are the principal crop-producing soils of the region. The upland plains of two types—lower, near the rivers, and upper, over the rest of the region—are fairly well-dissected and well-drained areas. Their soils average moderately heavy but have a strikingly friable structure. They have good productivity, but, without the aid of artificial fertilizers, are short-lived.

The Rivers.—Practically all economic activity in Amazonia depends closely upon the Amazon and its tributaries. Not only do the rivers afford facilities unmatched elsewhere in the world from the standpoint of depth and width, as well as length, but owing to the low elevation of the region as a whole gradients are gentle and velocities low. The Mississippi scarcely approaches the Amazon with respect to natural fitness for navigation; but the regional settings of the two systems cause the former to be one of the greatest water highways of the world, the latter to be one of the less significant water routes to the world at large, though absolutely vital to Amazonian life.

From earliest days the value of the Amazon as a thoroughfare has been recognized. In the eighteenth century there existed an astonishingly active trade between Pará and up-river points. Boats manned by oar or propelled by sail navigated lazily up and down the main river and its confluents. In 1866, utilization of the river took a long step forward as a result of the opening of the Amazon to international commerce. Soon the steamship completely displaced movement by sail or oar, until today Iquitos in Peru has regular connections with Manáos, Pará, and the world in general.

REGIONAL ECONOMY

Industry in Amazonia tends to devolve almost entirely upon what man has found as stored resources. For some time, no widespread

exception to this tendency can develop, owing to the almost insuperable obstacles of scant population, great distances, and dense forests. Although at present, quantities of sugar, rice, cassava, cacao and numerous minor provisions are produced, chiefly about the mouth of the Amazon, extractive industries based upon the forests predominate (Fig. 225). These industries produce a great diversity of

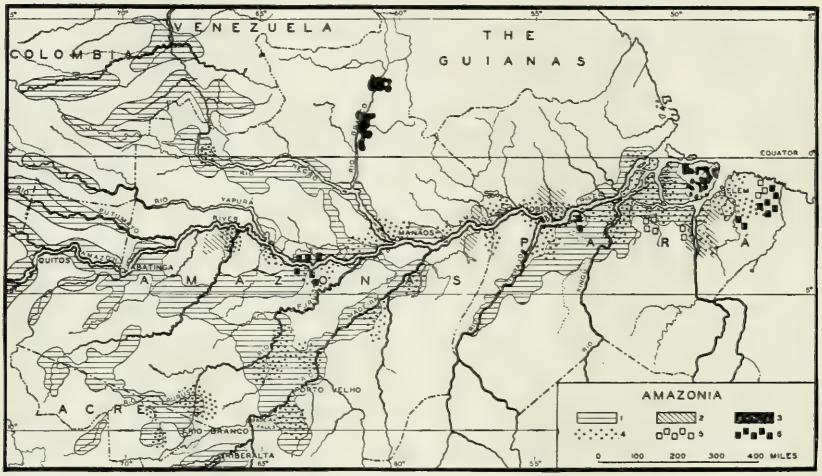

Fig. 225. Product Map of Amazonia

Along most of the major streams and at the headquarters of all rubber-gathering stations are patches of corn, cassava, sugar cane, and some fruits, the chief subsistence crops of Amazonia. Each of the large rubber companies has small patches of grazing land for the draft animals of the estate. (1) Principal rubber-gathering districts, (2) chief areas of cacao production, (3) large savanna areas with well-developed cattle industries, (4) areas of Brazil-nut gathering, (5) rice cultivation, and (6) tobacco districts.

wealth. The inhabitants procure abundant supplies of various foodstuffs as well as shelter, valuable timbers constitute an enormous resource, oil-producing seeds and nuts promise huge commercial development, but by all odds the major product of Amazonia long has been rubber.

Rubber.—The highly prized latex, obtained principally from *Hevea brasiliensis,* has done more to alter the cultural aspect of Amazonia in the years since the 1870's than any other single factor. Were it not for rubber, it is likely that the region would have languished for years with only a desultory gathering of various forest products. But the presence of one tree in particular has affected life in every part of

the land. This tree has led man far into the interior where now the remotest portion of the forest may shelter the rubber-smoker's hut. To a large percentage of the people, it furnishes almost the sole means for sustenance; this to an extent somewhat less than one-quarter century earlier. Moreover, in the light of recent developments by automobile interests of the United States, the tree may again achieve an influence as great as it formerly held.

The *seringueira* (*Hevea brasiliensis*), by far the principal rubber-producing species of Brazil, grows chiefly in the zone of the upper Purús, Juruá, and Acre Rivers, as well as in the lower Amazonian lands. The rubber worked from its latex excels all others in quality and is the "Para" or "fine" rubber of commerce. Inasmuch as the tree grows in the lowlands which are wet or repeatedly flooded, tapping takes place in the drier season. The life of the native tapper is a difficult one, not only because his daily rounds to collect the yield of sap drained from the incisions in the trunk entail considerable labor, but also because of the extreme unhealthfulness of the lands where the *seringueira* flourishes. Nevertheless, the attractiveness of much wealth in the dry season and unbroken leisure in the wet season enables the rubber industry to support more than one-third of the people in the region.

Among numerous other sources of rubber, *Castilloa elastica* is most important. The tree grows generally in the dry uplands in the higher basins of the Yavari, Juruá, and Purús Rivers and also on the territory to the north and south of the lower Amazon. The inferiority of its product, known as *caucho*, makes ruthless methods of exploitation the rule. The common practice involves cutting down the tree and has resulted in virtual extermination of the species over large areas.

The *balata* industry, closely related to that of rubber, in recent years has acquired significance. Today the Amazon Basin is the world's chief source of supply, most of the product originating in the Peruvian portions. The Brazilian output aggregates more than one-fifth that of the world.

Early Development of the Brazilian Rubber Industry.—Although the wild-rubber industry of the Amazon region is almost a century old, rubber did not figure prominently in Brazilian exports until about 1870. The exports increased from 10,000,000 pounds in that year to 93,000,000 pounds in 1912, the peak in the trade (Fig. 226). As long

as the world demand for rubber for bicycle and buggy tires, clothing, and boots increased steadily, Brazil was able to meet the needs, producing practically the entire world supply until 1909.

During these years rubber-gathering, as carried on in the Brazilian forests, was an extractive and destructive industry. Scores of alien companies exploited the area in many ways. Fortunes were made through the sale of shares, workers were driven to the limit, and money was spent lavishly in building towns. Inflation ruled; the industry "boomed," credits were extended throughout the various

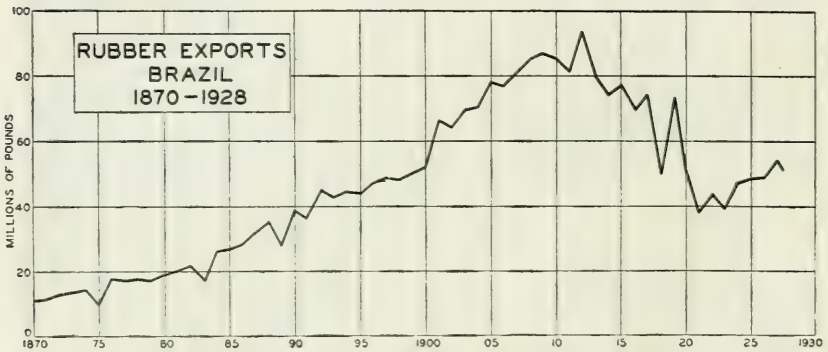

FIG. 226

Brazil supplied the world with rubber until the opening of the twentieth century. Increasing shipments of plantation rubber from the Far East after 1900 and heavy export taxes on wild rubber from Brazil brought on the crisis in the industry from which it has never recovered and probably never will.

branches of the rubber business, preparing the way for the disastrous crisis which followed.

For 20 or 30 years rubber created millionaires in Brazil. The revenues of the states of Amazonas and Pará were swollen by the high export duties placed upon rubber,—amounting in some years to one-third of its market value,—while the income of the federal government grew rapidly, fed by the taxes on the swelling volume of imports which flowed to the Amazon Valley to supply the wants of cities suddenly grown rich. But while the Brazilians were enjoying their recently acquired wealth and levying higher and higher duties, developments in other parts of the world were undermining the rubber trade of the Amazon.

The Crisis.—Plantation rubber from the Far East began to enter the world market in significant amounts about 1909, in which year

3,380 tons were marketed. This equaled only 4.6 per cent of the world production. Producers in the Amazon showed little concern over the possibilities of this competition until the early part of 1910, when the amount of plantation rubber placed on the market was sufficient to cause a break in the high prices. This crisis resulted in the ruin of most of the rubber firms in Manáos and Belem, and also of many producers carrying extended credits.

Thus facing complete ruin, the rubber interests of the Amazon Valley appealed for government aid, and a valorization scheme was put into effect in 1911. The government attempted to accumulate and withhold large stocks from the market in order to keep up the price. Its plan failed miserably, however, for Brazil no longer dominated the world market. Plantation rubber had come in to wrest from Brazil its second greatest industry, and no government aid or policy could stem the falling tide. Thus this great industry passed into history as had sugar in colonial Brazil and gold and diamonds in the eighteenth century.

The exports of wild rubber from Brazil decreased from 93,000,000 pounds in 1912 to 40,000,000 in 1923; in the former year rubber amounted in value to 20 per cent of the total exports of Brazil, and in the latter to only 2 per cent. During the first years of the industry in the Amazon Valley Brazil produced nearly all the world's rubber; now it supplies a bare 5 per cent.

Possibilities of Wild Rubber.—It has been demonstrated beyond a doubt that wild rubber cannot compete with the plantation product; also, that the wild-rubber industry is unable to supply the enormous quantities of rubber demanded by the growing automobile business. Furthermore, the Eastern plantations furnish a cleaner and a more uniform article at a price at which wild rubber cannot be produced profitably, except in certain favorable localities.

The Amazon region contains enormous numbers of fine trees of both *Hevea* and *Castilloa*. Yet the future production of wild rubber in the Amazon Valley will depend more upon the trend of market prices than upon the number of rubber trees. Several years ago, with the restriction of exports of the plantation product according to the "Stevenson Scheme" and the consequent rise in the price of rubber, the Amazon Valley increased its exports a few million pounds. A rise in the price for only a short period, however, does not greatly

aid the wild-rubber industry. Today the Amazon region lacks capital, men, and organized transport facilities. In order to increase the output materially it would be necessary to (1) collect the labor available in the valley, (2) import labor from Ceará and Maranhão, (3) locate and build supply stations and stores, (4) clear roads and trails of jungle growth, and (5) make certain that one export tax or another would not take most of the profit out of gathering the wild product, as had happened in the years immediately preceding the collapse of the wild-rubber industry. Capital to accomplish these things quickly is not available, no matter how sharply the price of rubber rises.

Possibilities of Plantation Development.—The physical conditions in the Amazon Valley—soil, climate, relief, drainage, and vast area—are as suitable for rubber plantations as are those of the Far East, if not more so. Vast areas are the natural home of the rubber tree, and many now support fine native trees of the best kinds. There appears to be no physical reason to prevent plantations from giving even better results in South America than in the Far East (Fig. 227).

On the other hand, economic and political conditions on the whole are not so favorable in the Amazon Valley as they are in the Far East. The former region has an inadequate supply of labor, while the latter has an abundant supply of intelligent labor which costs less than that of the Amazon Valley. It is probable that the labor cost of bringing an Amazon area into bearing would be 50 per cent of the total cost, whereas in the Far East it is not 40 per cent. Land leases in the Malay Peninsula are perpetual and unlimited as to area. In Brazil lands are sold or leased, the charges being graduated according to the location of the land and the area which may be obtained is commonly fixed by law. Taxes on land in the Amazon Valley are much lower at the present time than are rentals in the Far East, but in Brazil the export duties are higher. In addition, municipal, professional, sanitary, and other taxes in the Amazon region advance the total to 18 per cent or more of the total cost. Finally, political conditions favor the Far East. There the areas for planting lie within regions controlled by European powers, a fact giving reasonable assurance that guaranties will be adequate. The state governments and the federal government of Brazil have expressed an interest in the investment of foreign capital in the rubber industry, but it is too well known

that policies vary considerably between states and the federal government and sometimes from one administration to another.

A case in instance of the unfortunate variance of state policies developed recently over a situation which may mean the return of Amazonia to its former rank of the world's premier source of rubber.

FIG. 227. MODERN METHOD OF TAPPING RUBBER TREE

Though physical conditions in the Amazon valley are as favorable as those of the Middle East, economic conditions and political interference may forever prevent Amazonia from developing a great plantation rubber industry. (*Courtesy of the Pan-American Union.*)

In developments upon an enormous lease of land in the lower Amazon, a United States manufacturer of automobiles has pursued experiments to determine the selection of suitable trees. In the face of what this may signify to the entire region, appeal to the federal government was made necessary in order to take seeds of rubber-producing trees from the state of Amazonas into Pará. With such handicaps, in all probability Brazil will not witness any great development of either wild or plantation rubber in the Amazon Valley for years to come, if ever.

Brazil Nuts.—The diversification of occupations following the collapse of rubber so encouraged the gathering of the Brazil nut that this industry now has become second to rubber among forest activities in the region (Fig. 228). Production centers about Manáos and Pará, where the tree, the *castanheiro,* flourishes on the well-drained uplands. The industry has considerable promise, though as yet markets are small. Since only the fruit of the tree is used, collecting of the fallen capsules containing fifteen to thirty nuts does no direct harm to this

Fig. 228. Transporting Brazil Nuts

Native *castanha*—Brazil nut—gatherers carrying loads of nuts to river boats; the picture shows a typical dense growth of Amazon forest. (*Courtesy of Dr. Arelino.*)

resource. Moreover, the tree is widely and abundantly dispersed. The nut has high food value and the natives consume it in quantities. Collection involves simply going into the forest when the nut has matured sufficiently to fall from its lofty perch in the giant trees. Though the gatherer runs a serious risk of injury by the falling capsules, which may weigh from 3 to 4 pounds, his profits are attractive. When a certain amount has been amassed, a near-by stream generally provides eventual access to shipping points.

Minor Forest Industries.—The lumber industry has reached only small proportions and in all probability never will become an important branch of activity in the region. As in all tropical regions, most

of the timber is extremely hard, has high specific gravity (rafts of light woods are required to float many timbers), and lacks pure stands. In addition, the forests lie far from centers of population and efficient means of transportation. In this case, too, the region has an industry which labors under the burden of unwise export duties (Fig. 229).

Although certain woods already have acquired a market, growth continues slowly. The cabinet woods of quality include a number of

FIG. 229. SAWMILL AND TIMBER STATION IN THE AMAZON DELTA

Amazonia contains a vast amount of hardwood timber, but the difficulties of cutting and transporting the heavy timbers to river ports will keep down the output of lumber until the demands for such materials in the temperate regions are much greater than at present; since many of the more valuable woods of the tropics will not float they must be transported in rafts buoyed up by lighter logs. (*Courtesy of C. F. Marbut.*)

varieties, but a soft wood—known as the "cedar"—is cut in greatest volume as a result of its occurrence near the rivers. Since the "cedar" has both Paraná pine and United States yellow pine with which to compete, its markets are necessarily limited.

The diversity of plant life has led to a number of small-scale commercial industries, among which various oil-producing seeds have principal importance. A salient development of recent years depends upon the babassú nut. The tree, a palm (*Attalea funifera*), grows extensively in the lower Amazon region, chiefly in the state of Maran-

hão. Of a utility to the native rivalling that of the *moriche* palm on the Orinoco delta, for it furnishes food, shelter, clothing, fuel, and illuminant as well as serving to smoke-cure rubber, it promises to give rise to an outstanding regional activity. Commercially, it has great possibilities as a foodstuff as well as a base for the finest grades of soap.

Cultivated Crops.—The wealth of forest foodstuffs and the effect of comparatively high wages to be gained by gathering rubber have

Fig. 230. Primitive Agriculture, Southern Maranhão

Over most of Amazonia agriculture is of a primitive forest type; a small patch of land cleared of trees or burned over and planted to corn, cassava, or cane receives little or no attention until the time of harvest; under the tropical heavy downpours the soils leach rapidly. (*Courtesy of Ernest G. Holt.*)

naturally prevented much agricultural development. Nearly all production goes to local markets or is part of a subsistence agriculture. Sugar-cane, cacao, cassava, corn, rice, and various fruits supply the bulk of necessities; of these, corn occupies the largest acreage. Extremely crude methods prevail. For nearly all crops, the district about the large market at Pará has the greatest acreage. The potentialities for expansion in the production of sugar, cacao, and cotton are great and the continued diversification of industries will cause considerable, though slow, growth. Amazon cacao at one time supplied all of the world's trade in that commodity, only to decline with the rise of rubber and with the onset of numerous difficulties involving

disease, floods, poor methods, taxes, and extra-regional competition. Today the chief centers of production lie between Manáos and Obidos and about the mouth of the Tocantins and occupy parts of the alluvial plains (Fig. 230).

Livestock.—With more than 500,000 head living on the frequently flooded pastures the grazing of cattle has considerable significance on the island of Marajó. Minor grazing lands include the savannas to the north of the estuary and the several alluvial plain grasslands. The grasses are neither particularly palatable nor nutritious, beef of fair quality being produced for markets solely within the region; encumbered with tropical diseases, insect pests, and low-grade animals, the cattle industry of these far-away savannas can experience little development until more temperate pastures of the continent have been utilized.

In the lands about the Rio Branco headwaters lies a grazing district of particular import to the interior. Here more than 150,000 cattle graze over an extensive area and provide a valuable source of beef and by-products for Manáos and a large surrounding area. Together with exports from the Rupununi savannas of western British Guiana, the cattle, shipped alive as a rule, descend the Rios Branco and Negro, on barges to Manáos.

THE AMAZONIAN PROSPECT

Amazonia has enormous potentialities in certain fields, only to be fully realized by enormous expenditures of time, money, and men. A utilization of resources approaching that of other plains of the world is beyond the realm of likelihood; yet the great lowland has capabilities for producing various valuable commodities in quantities exceeding those possible in other tropical humid regions. Handicaps attendant upon vastness diminish in significance as stage of utilization progresses.

The land has to contend principally with: a climate repellent to white men; vegetation so dense and so lush as to hamper seriously ordinary overland transportation; soils quickly exhausted under cultivation; extensiveness, ameliorated somewhat by the peerless system of navigable rivers; scant people of inferior calibre. Despite these shortcomings, the region may develop considerably along present lines, since purely extractive industries prove equal to the task of

finding markets. At any time, however, traditional governmental obstructionism may bring about a fatal relapse in any or all activities.

In all probability, rubber will long retain predominance among regional products. More and more it is becoming indispensable in world industry and Brazil apparently has the largest single area in the world physically suited to its exploitation. Brazil nuts produce much wealth with comparative ease but markets for a relatively expensive delicacy increase slowly. Timbers can undergo no great transformation in importance. Numerous other commodities, too, the babassú nut most recently, add to the list of Amazonian resources; all depend upon the wealth of the forests, and will contribute to the development of the region.

As these industries gain headway, inducements to population for settling the region will increase. The streams will continue indefinitely to determine the localization of these peoples. With increased population and consequent markets as well as facilities, agriculture has opportunity for advance. As a producer of foodstuffs for the world, the region can promise little as yet. Nevertheless it has physical conditions suitable for many crops. Development may come, but the way is beset with obstacles, difficult and expensive to overcome.

CHAPTER XXXVI

ECUADOR

In total area, Ecuador surpasses Uruguay; but in respect to area of land actually productive under the care of men, Ecuador is the smallest South American republic; also, in per capita trade, Ecuador holds a minor place; the Ecuadorian participates in world trade to only one-seventh of the extent customary of the Uruguayan. The underlying handicaps may be attributed to location—athwart or close to the equator on one hand, and athwart the Andean super-barrier on the other. The former condition of location forms the basis for the country's leading industries; the second makes possible a notable concentration of population in the intermontane plateaus. Thus producer and ruler inhabit widely different geographic regions, resulting in an additional group of hindrances of grave consequence,—hindrances reflected in the bewildering and completely detrimental series of revolutions recorded in national history. Over-specialization in a single crop, cacao, adds to the list of influences which relegate Ecuador to the ignominious ranks of chronically debtor countries of small revenue.

No brilliant commercial exploitation arose here in colonial days. No riches of gold and silver flowed from the Cordillera. In two hundred and eighty years of Spanish rule, the land did little to swell the coffers of the mother country. Independence simply enhanced the lack of progress; in fact, it resulted in retrogression for some time. Most commonly, presidents of the country have gained office by force and have left office under armed compulsion.

The composition of population points to a prolonged continuance of such conditions. As in several other South American countries, particularly Chile, a small landed white aristocracy owns most of the valuable land which is held in vast *haciendas*; this group composes less than one-twelfth of the entire population of some 2,000,000. This moneyed element has shown little interest in the country except to obtain profits with least effort. Voluntary expatriates are numerous.

The lower strata of population embrace Indian, negro, and mestizo, who labor on the cacao and coffee estates, weave Panama hats, gather *tagua* and rubber from the forest, and in cases abstain almost completely from commercial intercourse. They have neither means nor inclination to work for more than the necessaries of life, which for them are few.

Though the Pacific Lowlands contain the largest city, the zone of Andean Mountains and Plateaus has the most dense population. The Eastern Lowlands, aside from the trouble they occasion in boundary disputes with Peru, contribute practically nothing to national standing. The attractiveness of the highland in latitudes about the equator guarantees the predominance of the Sierra as the center of population. Much of the area has a density equal to that in the coffee lands of São Paulo or in the Central Valley of Chile,—between 30 and 60 persons to the square mile. Quito, capital of the country, holds sway over the north with a population of 50,000; Cuenca serves a large district in the south and has accumulated 30,000 people. At the head of the Gulf of Guayaquil lies the city of Guayaquil, the trade center for all Ecuador, having easy access to the leading producing districts of the country, especially the cacao developments in the Guayas lowland; it has more than 100,000 people. The remainder of the Pacific slopes and lowlands has few important concentrations of population. In general, it embraces numerous villages in the forests, so that population is relatively dense. East of the mountains, almost one-half of the country's generally accepted total area of 110,000 square miles has a population more scanty than that of far greater areas in Brazilian Amazonia.

At the same time that it affords the most livable portion of Ecuador, the Sierra augments the country's handicaps by its influence on internal transportation. At the east, the change from plain to lofty mountain chain is so abrupt that the eastern lowlands scarcely figure in Ecuadorian economic life. Only a few hazardous trails negotiate the heights to permit convoys of mules or men to carry the meager production of the forested plains to the plateau and to return with a few supplies. To the west, conditions improve but do not encourage much road-building. The railway from Guayaquil to Quito, the only line between highland and lowland, incurred great expense in construction, but has shown disappointing returns. Even on the

plateau, the topographic interruptions have prevented beneficial extension of facilities. To reach Cuenca, the third city of the republic, the traveler must take to rail, road, and trail. In all, Ecuador has 530 miles of railway and 542 miles of highways of only fair quality. The rivers debouching about the Guayas River provide ocean facilities a considerable distance into the cacao lands, but in general

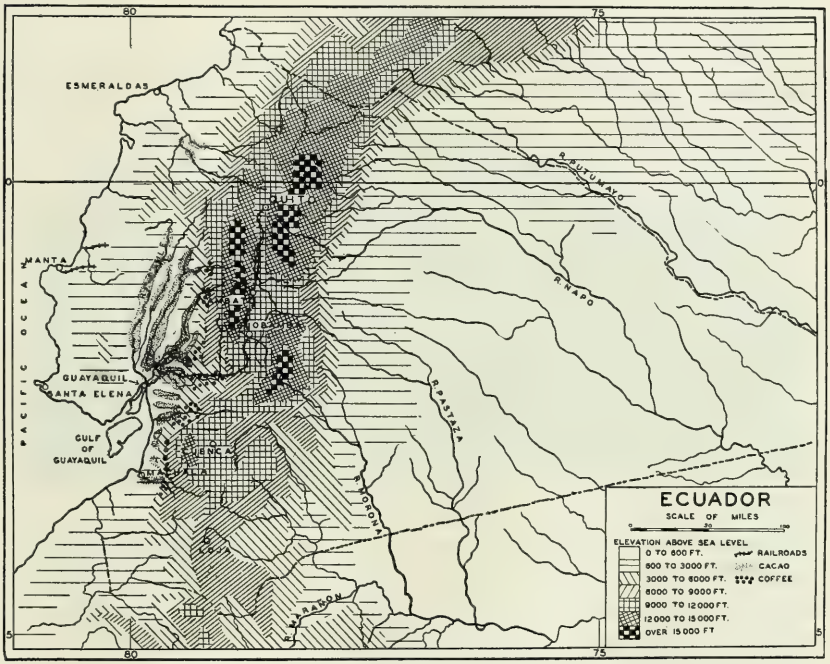

FIG. 231. PHYSICAL AND PRODUCT MAP OF ECUADOR

Ecuador consists of three major regions; the Pacific Lowlands, the Sierra, and the Eastern Lowlands; the Guayas and Daule Lowlands and the basins in the Sierra support most of the people of the republic.

throughout the whole Pacific Lowland and the Cordillera region travel and transportation depend upon mules and llamas clambering over slippery and dangerous trails. Guayaquil, the country's one important port, though hindered by the notorious unhealthfulness of its site—a condition now considerably bettered—has favorable connections with ocean shipping. It lies some 40 miles up the Guayas River and directly opposite the terminus of the rail link to the Sierra.

On the basis of conspicuous differences in physical character en-

hanced by the paucity of transportation facilities, and the consequent development of characteristic economies, Ecuador falls readily into three geographic sections, viz., the Pacific Lowlands—divisible into the arid districts of the southwest and the humid slopes and lowlands—the Andean Mountains and Plateaus or Sierra, and the Eastern Lowlands or Oriente (Fig. 231).

THE PACIFIC LOWLANDS

The lowlands stretching from the Andean foothills to the sea constitute the most productive exporting areas of Ecuador. Here the Pacific coastal plain of South America reaches its greatest width, from 80 to 100 miles, and has soils of great fertility. Its area approximates 30,000 square miles. Near the foot of the Andes, about 1,000 to 1,700 feet above sea level, a broad belt of fine sandy loam alluvial soil with a good supply of humus, and well-drained, stretches across the country. Westward the Palenque and Daule plains, low, flat, and with belts of black clay soils and imperfect drainage, produce a variety of crops but are not suitable for cacao. The lower Guayas valley, occupied by heavy gray and black stiff clays, are valuable for rice culture and a variety of native grasses. In southwestern Ecuador broad tablelands and sandy ridges occupy much of the region. Farther north and back of flat mangrove swamps the land rises into low rounded hills of friable red clays. Here and there a narrow valley points the way into the interior and affords fertile stretches. Though in various places mountains rise to 3,000 feet, the aspect of plain preponderates as a whole in western Ecuador.

Climatically, the region presents considerable differences. Though much of the area has a hot rainy climate, portions in the south have a true desert climate representing the northerly extension of the Peruvian Coastal Desert. Heaviest rains, from 60 to over 80 inches per year, fall in the northwestern littoral and at the eastern head of the Gulf of Guayaquil. To the east of the Guayas River lies a heavy rain zone on the Andean foothills and the middle slopes; 90 to 100 inches fall during a year; even the driest months, July and August, get drizzling rains that last from 6:00 P.M. until 7:00 or 8:00 next morning; it is a belt of constant clouds and fogs drifting up the slopes and valleys. The interior receives between 40 and 50 inches. Southward a distinct dry season—June to November—becomes more and more

pronounced, although local eminences occasion more uniform distribution in certain areas.

Vegetation types correspond closely to drainage, soil conditions, and amount and distribution of precipitation. The low swampy coastal and deltaic plains support dense mangrove thickets. Except for coconut palms, few trees invade these stretches. Stiff clay lands and areas of marked seasonal distribution of rains consist of savanna lands of native and *Pará* grasses, with here and there a scattered growth of *acacias* and groups of palms. In the arid portion of western Ecuador xerophytic types dominate; here the giant cactus (*Cactus*

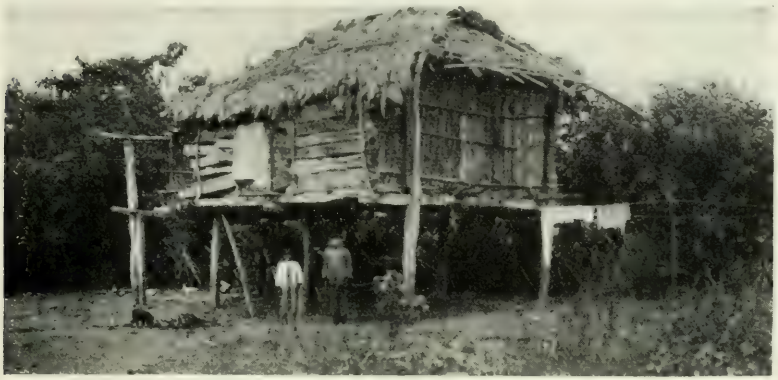

Fig. 232. Typical House of the Pacific Lowland

A better-type home of the poorer classes of people; only the wealthy natives can afford staircases and tiled roofs; note the ducks, chickens, and pig, important sources of food for the natives. (*Courtesy of Nels A. Bengtson.*)

opuntia), thorn bushes of many types, *algarroba* and its relatives (*prosopis* and *mimosa*), *palo santo* and several grasses, partially clothe the sandy ridges, valleys and tablelands. The dense tropical rain forest covering most of the region contains valuable elements, including principally cacao, the *tagua* or vegetable ivory palm (*Phytelephas macrocarpa*), *toquilla* (*Carludovica palmata*)—source of fibers for Panama hats, *balsa, guayacán, cedro,* laurel, *ceiba,* and *caucho.*

The distribution of population is notably irregular, the district about the Guayas alluvial lowlands having most of the people. In the forest lives a motley assortment of Indians, negroes, and various crosses (Fig. 232). Some of the Indians and negroes live entirely independently, refusing to labor in the forest or on cacao estates. The latter have reverted to virtual barbarism since the abolition of slavery

and obtain some income from sporadic workings of auriferous gravels. The laborers of the agricultural zones live in a state of subjugation scarcely more advanced than that of the forest-dwellers. Hard work in an unhealthful climate, low wages, and a pernicious system of bondage dependent upon keeping him perpetually in debt make of the *cholo* a listless and backward specimen of humanity. Plantations can secure relatively efficient labor only by constant and expensive supervision.

Regional Development.—By all odds the Pacific lowlands of Ecuador are considered the potentially richest region of tropical western South America. To Ecuador, they constitute a vital source of revenue and practically the only source. Most of their wealth depends upon their almost ideal adaptability to the growth of cacao along the rivers flowing into the Guayas. In addition, the collection of *tagua* nuts, the manufacture of Panama hats, the commercial production of coffee and cotton and a small amount of grazing tend somewhat to round out the industries of the region. The bulk of activity is almost totally dependent upon foreign markets. Manufacturing, other than the handiwork industry of Panama hats, embraces principally the preparation of foodstuffs and various small wares destined for local consumption.

Cacao.—For a long time Ecuador dominated the world's output and market of cacao, contributing one-third of the total in 1900 but less than one-tenth in 1928. Although it led all other producing regions until a few years ago, expansion in Ecuador did not keep pace with world consumption and the production of other regions.

Cacao has been the leading commodity of Ecuador since the early days of the republic, furnishing in some years as much as three-fourths of the exports. It has been to Ecuador what nitrate has been to Chile, supplying for more than fifty years much of the governmental revenue. The exports of cacao rose gradually, with a constant increase in world demands, from about 2,000,000 pounds in 1850 to 41,000,000 in 1900; then they rose to 109,000,000 pounds in 1916, the peak year of shipments (Fig. 233). This growth resulted from an active demand for the high-quality cacao of Ecuador, from the soaring prices, and from favorable conditions of production.

In the Guayas and Daule Valleys and on the adjacent plains, some 6,000 cacao estates with about 100,000,000 trees embrace 250,000

acres, or only three-fifths of 1 per cent of the area of the country. In these alluvial plains the clay loam soils, high humidity, temperatures ranging from 70° to 93° F, more than 70 inches of precipitation fairly well distributed throughout the year, a short less rainy season of abundant sunshine, and an absence of winds favor the production of big yields of high-quality cacao. *Arriba* cacao enjoys a great demand by chocolate manufacturers, who consider it excellent raw material if the beans are picked ripe, thoroughly fermented, and dried in the sun. Cheap Indian labor aids the industry on the extensive plantations which produce most of the output. Since little care is

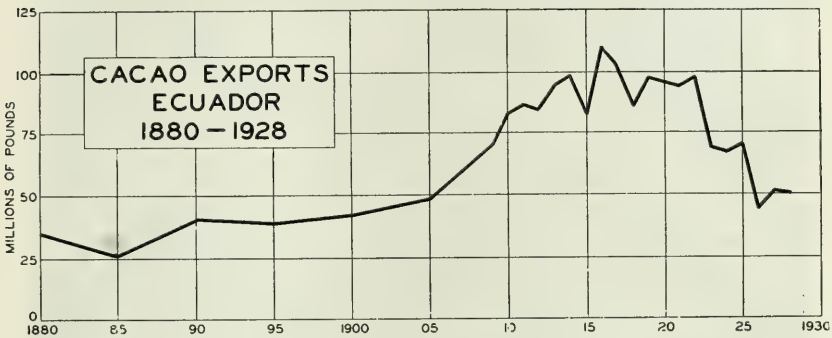

FIG. 233

Upon the exports of cacao depends Ecuador's position in trade; from a position of dominance in world trade in cacao, the republic has rapidly declined in importance; expansion in Ecuador has not kept pace with world consumption and competing producing areas.

given the trees except to provide some shade for them and chop out the underbrush while they are small, not a great deal of labor is required except at harvest time. Although some fruit ripens all the year, the three different crops—the principal (or winter) crop harvested from February to April, the summer crop from July to October, and the Christmas crop from November to January—equalize the flow throughout the year, an advantage not enjoyed by some other regions. River barges or boats afford cheap transportation to ocean vessels at Guayaquil. On these cacao estates, some under foreign control, profits have been high, mounting to as much as from 15 to 25 per cent on the investment during the peak years of the industry (Fig. 234).

But extensive areas of virgin lands, with exceptionally favorable

conditions for the growth of cacao, did not keep Ecuador in the front rank as a cacao-producer. The planting of new areas did not keep

FIG. 234. DRYING CACAO, GUAYAS LOWLAND

Cheap labor is essential in gathering and drying cacao; upon the proper curing and drying process depends, to a considerable extent, the quality of the cacao. (*Courtesy of the Pan-American Union.*)

pace with world demands; indeed, many of the owners of plantations resided in foreign countries, living on the income from their huge estates, which they entrusted to a manager who cared little for the

future of the property. As the increasing price of cacao gave big incomes, even from decreasing yields, the owners made very few new plantings. Moreover, foreign companies with sufficient capital necessary for the establishment of whole new plantations, not being able to get satisfactory assurance of favorable financial policies in Ecuador, went elsewhere to invest in cacao production. The natives, under poor supervision, harvested both ripe and green beans, and neither sorted them carefully nor dried them properly, thus producing an inferior commodity which injured the market. Increasing export duties made competition with cacao from new regions more and more difficult; in a recent year taxes of one kind and another totaled 2 cents per pound on exports.

Furthermore, on the crest of the period of greatest prosperity in the industry, from the high prices of the first years of the World War, the *monilia* disease, which attacks the fruit, broke out in 1916 and caused great losses; as a result, exports decreased 25,000,000 pounds in 2 years. The industry has not recovered from this setback, although in spite of world depression and uncertain financial conditions shipments averaged 95,000,000 pounds from 1919 to 1922 inclusive. In June, 1922, the witches'-broom disease, which attacks the trees, broke out, spread rapidly, and caused the abandonment of many plantations. It has spread to most of the properties in the Guayas and Machala regions, the chief cacao districts of the country and threatens to wipe out the entire industry. Exports decreased to less than 35,000,000 pounds in 1928, nearly to the level of the shipment of more than 35 years before.

Consequently depression prevails throughout the nation; although various commissions have been appointed from time to time to investigate and report upon the witches'-broom disease, aside from experiments by individual growers, little or nothing is being done to combat it. On many of the older plantations it is not practicable to prune the trees, thin out the shade, and remove the abnormal growth of witches'-brooms because of the great size of the trees, their closeness together, and the lack of sufficient labor. Several of the largest estates, lying at the base of the mountains and nearly always shrouded with clouds and mists, face complete ruin, since some sunshine each day is necessary in checking the disease. Even on the newer plantations away from the mountains it may not be profitable to spend large

sums of money to fight the witches'-broom and then have to market the product in competition with that from regions favored by natural and economic conditions and free from diseases. It may be that the cacao industry of Ecuador is doomed and that the nation may be forced to relinquish to the ravages of diseases and to competition from less unfortunate regions its greatest industry, which has been the financial backbone of the republic for three-quarters of a century.

Coffee.—Second among cultivated crops in the country, coffee holds a minor rank. The crop grows in several parts of the region on the western flanks of the Andes to elevations of 5,000 feet, most of the output coming from large plantations east and south of Guayaquil. Good drainage, fertile red clay soils, auspicious climatic conditions, nearness to ocean transport, and the straits of the cacao industry favor increased progress; planting rapidly spreads. Under favorable conditions the coffee is of excellent quality, but generally with a lack of dependable labor, as well as of capital and machinery, it averages low in quality resulting from poor methods of preparation; competition with areas better favored in many ways hinders expansion.

Minor Commercial Crops.—To suffice for domestic textile industry requirements as well as to supply a surplus for export in most years, cotton has made great strides in recent years. The chief areas of culture lie in the upper Guayas district, in Esmeraldas, and in more arid sections where some perennial tree cotton grows. Opportunities for large-scale development are few, owing to the poor methods of cultivation, little care in picking and preparation, and the limited area where rains permit cotton to mature properly.

Climate and soils favor a considerable production of sugar, largely for domestic consumption. Much of the output is turned into rum, although a few modern sugar centrals have been established in the Guayas area. Methods are prevailingly crude, but several ratoon crops may be obtained.

Subsistence crops include a diversity of foodstuffs, in addition to the cane; corn, rice, cassava, beans, bananas, plantains, mangoes, breadfruit, coconuts, and others. The ease of obtaining large supplies of such crops on small forest clearings or among rows of cacao, coffee, or cotton, contributes to the shiftlessness of the average inhabitant. Cultivation is the exception; machete and hoe are the only implements used. Hence in the case of the forest-dweller, his prized leisure may

be enjoyed in safety, and he can loll around in the shade of his rudimentary palm-thatched hut or glide down a tropical stream in a dugout catching fish.

Grazing.—For the region as a whole the grazing industry rests in a backward state. The forest negro tends no animals. He provides his meat from the waters of the rivers or the forest solitudes. On the other hand the inhabitant of the arid thorn-bush country of the southwest places almost complete dependence upon his herds of goats, a few swine and cattle. Much of this arid region, parcelled out in vast ranges, provides fair pickings for the hardier animal. Here a man's wealth is measured not in hectares of land possessed but in the numbers of goats and cattle that he keeps; the family home, more often than not, consists of a house perched on high poles in the goat pen. Ranges of exceedingly low carrying capacity support only animals of low grade.

The better grazing areas line for miles the low flat lands, of heavy clay soils, along the lower Guayas and other rivers of the region. Here large areas of savanna lands of several tall native and *Pará* grasses provide plenteous forage for many cattle. But the industry suffers under many handicaps characteristic of most tropical savannas: hard coarse grasses during the dry season, Texas fever, tick, hoof-and-mouth disease, numerous flies and mosquitoes, low-grade cattle, and lack of modern methods of breeding and grazing. The low-grade cattle supply in the best of flesh an inferior meat; in many sections they serve chiefly as draft animals. As with crop production few conditions point to advance in the grazing industry, as a living for the backward population is too easily obtained by primitive culture and by the desultory gathering of forest products.

Forest Industries.—Its forests have furnished Ecuador much wealth since early colonial days. Today, among the five leading exports of the country, three are derived from forest resources—*tagua* nuts, Panama hats, and rubber. Moreover, a lumber industry centered about Guayaquil and Esmeraldas supplies a large part of domestic needs, although the paucity of transportation facilities blocks noteworthy expansion.

Tagua, or vegetable ivory, has long been an important product of western Ecuador. The *tagua* palm (*Phytelephas macrocarpa*), a stunted palm fern 10 to 20 feet high, which grows wild in the tropical

forests of western Ecuador and Colombia, produces the vegetable ivory of commerce, a valuable commodity for an essential item of wearing apparel. The fruit, similar to the coconut, grows in from 4 to 9 drupes to the tree; each drupe, about the size of a man's head and weighing nearly 20 pounds, consists of a woody, fibrous, wart-covered wall that incloses from 20 to 40 seeds. The nuts are of hard white composition, fine-grained, and approximate real ivory in all characteristics.

After the fruit ripens, the drupes fall to the ground and usually burst open, the nuts either falling out or sticking in the fibrous pulp. Rodents and other wild animals, fond of the pulp, eat it and clean the nuts, which are then gathered by the natives, who go into the deep tropical forests for days at a time in search for the *tagua* trees, which are widely scattered through the forests. The nuts are brought out on the backs of natives, on mules, or in small boats. Unripe nuts gathered from the trees have a red tinge and bring lower prices than ripe ones do. The tree produces fruit the year round, but the principal crop comes during the months from January to May; many unripe nuts are gathered from October to December. The tropical fruiting throughout the year gives a fairly even flow of nuts to the markets.

Although the region supplies nearly all the world's vegetable ivory, a marked expansion in the industry is not to be expected. Vast areas of tropical rain forest favor the growth of the *tagua* trees on plantations, but the low value of the product prohibits the establishment of costly plantations and restricts the output to the activities of the native *tagua*-gatherers. In recent years of high prices it has been difficult to secure sufficient numbers of natives to go into the forests to collect nuts. Lazy negroes reluctantly sacrifice leisure to even gather *tagua* nuts. The industry depends upon very cheap labor and transportation. Furthermore, world demands and prices may not rise appreciably above the level of the past few years.

Of long standing, the gathering of *toquilla* palm fiber (*Carludovica palmata*), for the fabrication of Panama hats, hammocks, straw cigar holders, and other articles, occupies the attention of many people in western Ecuador (Fig. 235). The palm, presenting the appearance of diminutive fan-shaped trees without a trunk, attains a height of 6 to 10 feet in the heavy fertile soils of the lowlands and hot humid

slopes up to 5,000 feet. It thrives chiefly in the wild state, though in some sections it is planted. The fan-shaped leaves, 5 to 7 feet long, must be cut from the tree before they open; then stripped of their outer filaments, they are repeatedly dipped for a few seconds in a vat of boiling water, dried in the shade and a day or two later the straw or fibers from the leaves are bleached in the sun when they are ready for weaving.

The hats are woven chiefly by the women and children, who become skilled in the art. It takes days or weeks to complete a hat, since weaving is commonly done only in the early morning hours or in the evening, when atmospheric conditions favor the making of the best Panamas.

The industry is centered in the provinces of Manabí and Guayas,—the famous Monte Cristi and Jipijapa hats originating here,—but hats are made in many of the towns of the lowlands of the region and in those on the western slopes of the Andes. Hats woven in remote villages are bought up by native traveling buyers who deliver them to the exporting companies, which ship them to all parts of the world, especially to the United States and Europe. Also a steady demand for them exists in South American countries, where they are worn by all classes of people.

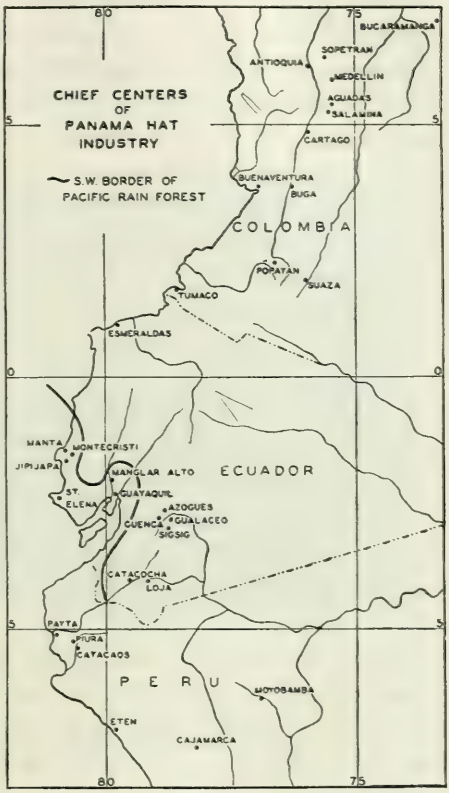

FIG. 235

The centers of the Panama hat industry are concentrated in southwestern Ecuador and in the western part of Highland Colombia; in both regions of fairly dense population, labor is cheap and painstaking, both of which are essentials in this industry. (*Areas in Ecuador after Rivet, and in Colombia after field notes and several sources.*)

This region for a long time produced the entire output of the world

but the *toquilla* palm has been introduced into Panama and Honduras, where its production forms the basis of a small industry. Foreign countries importing the straw have also begun to make hats which compete with the Ecuadorian product. Decreased shipments from the region have resulted in recent years from this competition, from imitation, and from the import duties which various countries have placed on them, thus raising the price beyond the means of the average person. The output of the region might be increased greatly as a result of better organization and more laborers. As it now stands, most of the cost of the hat is attributable to native hat jobbers, to importers, and to merchants' fees, and not to the long hours of painstaking labor required to weave it, for the patient Indian or mestizo, who laboriously weaves the hats, receives a dollar or two apiece for the common ones; yet these same hats sell for $12 to $25 in the United States.

Caucho rubber, the product of the *Castilloa* tree, constitutes the only Ecuadorian rubber of commercial importance, in spite of the fact that rubber plants of many kinds thrive in the lowland forests of western Ecuador and extend well up the slopes of the Andes. *Castilloa* and certain species of *Hevea* grow in the lowlands of eastern Ecuador; but any rubber gathered in these forests leaves by way of the Amazon, and Ecuador gets no credit for it.

Production depends entirely on market prices, for the output represents only the gatherings by unorganized natives. When prices are high, the negro or Indian bestirs himself to unwonted activity, but when prices fall he readily lapses into his customary state of indolence.

THE ANDEAN MOUNTAINS AND PLATEAUS

Between the two titanic ranges representing the Andes in Ecuador lies the granary of the country. To be sure, the Pacific Lowlands supply practically all of the exports, but it is on the intensively utilized slopes of the interior plateaus, at elevations between 7,000 and 10,500 feet, that 1,500,000 people live, three-fourths of the total population. Here grow the wheat, barley, corn, beans, and potatoes, and here graze the animals used to feed that population. With the lowland, intercourse necessarily is restricted by transportation difficulties; but various commodities, because of their climatic

limitations or because of regional conditions for manufactures, can pay the charges and form the basis for a fair-sized exchange.

The trough lying between the huge volcanic chains, in which Chimborazo towers to an elevation of 20,500 feet and Cotopaxi to 19,600, is by no means flat. Various transverse spurs subdivide it into numerous basins each supporting its own concentration of peoples. In addition, the rivers—which to the north drain to the Pacific and to the south to the Atlantic—have cut deep valleys on whose slopes

FIG. 236. QUITO VALLEY

Many broad basins and valleys of the highlands constitute the chief agricultural districts and contain the denser areas of population of the country; entire valleys and mountain slopes represent a patchwork of temperate cereals, vegetables, and grasses. (*Photo by Frank M. Chapman; courtesy of the American Museum of Natural History.*)

farming and grazing are notably well developed (Fig. 236). On the whole the basins are eminently suited to tillage and their undulating surfaces bear an intensive agriculture, although in the valleys and on the higher piedmont declivities terracing prevails. A high degree of skill has been attained in respect to terracing and prevention of destructive soil erosion. Dark sandy loam and loams characterize much of the land and have excellent productivity, although in older districts continuous cropping without proper rotation has impaired some of the land.

The climate resulting from the region's elevation is an especially salubrious one in view of the latitude, but it falls short of the attractiveness indicated by the phrase frequently applied to it as one of

"perpetual spring." Precipitation for most of the region averages between 40 and 50 inches per year, but numerous local variations occur, some small districts receiving as much as 100 inches, others recording desert conditions. Quito receives more than 40 inches, Ambato less than 20, most of which falls between September and June. Wherever possible, irrigating waters are utilized to assure moisture in sufficient quantity. Temperatures in the intermontane agricultural districts are comparatively low throughout the year,

FIG. 237. A WASHING SCENE, HIGHLAND ECUADOR

The clothes are washed in the river by scrubbing them on rocks or beating them; the century plant, shown growing on the stone wall below the tilled field, when beaten supplies suds for washing the clothes. (*Courtesy of V. R. Edman.*)

with small monthly variation; February, the warmest month, has a mean of 55° F, November, the coldest month, a mean of 54.3° F. Diurnal changes are great, the land warming quickly in thin air and under the high sun and cooling quickly at night. Frosts not infrequently cause widespread damage to crops even in the middle of the warmest season.

At these elevations, a bush type of vegetation takes the place of forest; it rarely exceeds 15 feet in height. This grades into the high grasslands which lie above 11,500 feet. The bush zone is that of greatest agricultural activity, the highest portions being utilized for barley and potatoes. The high cold grasslands, known as *páramos*, have a thin cover of bunch grasses, and afford considerable grazing area for sheep in particular. Where drier, these higher lands have many spiny growths, and are of relatively little value. Both to east

and west, the outer slopes of the Andes, to an elevation of almost 10,000 feet, support notably dense forests.

The average laborer working the land under direction by overseers is either Indian or Spanish-Indian mestizo. His long experience with highland agriculture, dating back to Inca days, makes him a fairly good farmer and he produces practically all of the foodstuffs required by the region. He lives in a small tile-roofed hut of sun-dried brick

Fig. 238. Threshing Cereals as in Biblical Days

On earthen or stone floors the grain is tramped from the sheaves by oxen and winnowed in the wind; note the brush brooms used for sweeping the threshing floors. (*Courtesy of Reuben E. Larson.*)

or of blocks of *cangagua*—a volcanic ash material—and manufactures most of the clothing and utensils required by his simple mode of life. Frequently the women may be seen making the picturesque clothes typical of the highland. Far more advanced than the lowland laborers, nevertheless these people likewise have developed an unprogressive nature bred under the yoke imposed by the landed class; their one great redeeming quality lies in their ability to farm (Fig. 237).

Sierra Industries.—In comparison with the Pacific Lowlands, the utilization of available resources in the Sierra is strikingly intensive. In contrast to all other Andean portions of western South America,

mining plays practically no part in this development. Large-scale manufacturing also is undeveloped. Quito produces various articles such as textiles and prepared foods, but a large part of the population provides for many of its own needs. Agriculture is the all-important activity. The average landscape presents a pleasing picture of intricately intermarked fields—in cereals, vegetables, pasture or woodlot. Animal husbandry in the higher lands and the raising of

FIG. 239. TANA INDIANS, ORIENTE, ECUADOR

The eastern plains of Ecuador are sparsely peopled by backward uncivilized groups of Indians that play no part in the economic and political scheme of things in the country. (*Courtesy of Reuben E. Larson.*)

eucalyptus for a wood supply constitute important adjuncts of regional economy.

On the average tillage of the land attains an elevation of 10,400 feet, although barley, *quinoa*, and potatoes may extend considerably higher in protected places. The principal crops are barley, corn, *quinoa*, potatoes, peas, beans, lentils, *oca*, and *olluco*. Occasionally small quantities of beans, corn, and lentils are available for export. Alfalfa fields hold a good part of the land; on these are fattened the cattle brought from the *páramo* pastures. Though a high degree of skill in utilizing every bit of good land or of irrigating water is characteristic, methods of farming do not provide for sufficient periodic enrichment of the soil. The use of fertilizer or legumes has little vogue; and careful crop rotation is almost unknown. Methods of

planting, tillage, and harvesting of crops are crude; the soil is turned or merely scratched with a crooked stick; crops are cultivated with hoe or machete; harvested by hand, the grains are threshed by trudging oxen on stone floors and by winnowing. Hence, low crop yields prevail in all parts of the region. Expansion in agricultural production can be effected only by improvement along these lines, for in the many centuries during which the region has supported a rather dense population virtually all of the easily available resources have come into use (Fig. 238).

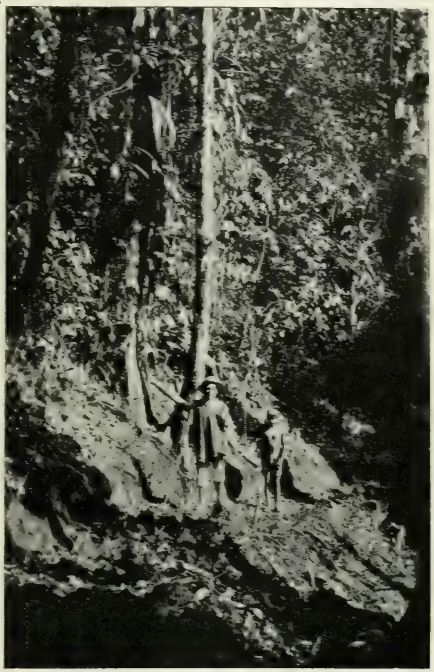

FIG. 240. AN ANDEAN TRAIL ON THE UPPER NAPO

With only trails, most of which are bottomless quagmires of mud during the rainy season, connecting eastern Ecuador with the highlands, few products can mount the Andean barrier and yield a profit on the Pacific coast. (*Courtesy of Reuben E. Larson.*)

THE EASTERN LOWLANDS

The *Oriente* of Ecuador, among the least developed portions of Amazonia, approximates one-half the area of the country in size, though its exact dimensions are politically debatable. It constitutes a land apart from almost all ordinary intercourse with the Sierra or the Pacific Lowlands. Its isolation is striking. Only a few exceedingly perilous trails bridge the abrupt transition from the towering eastern range of the Andes to the plains which stretch to the east. In the completely and heavily forested land live a possible 80,000 inhabitants, most of them pure-blooded Indians who have no contact with white men and desire none. The only outposts of civilization center about the shelter constructed by small numbers of Indians sporadically collecting rubber to ship down the Amazon, and in a few towns at the base of the Cordillera. Missionary work

represents the principal influence of the highland on the region, although some 500 whites at Macas, in the southwest, engage in a small amount of agriculture and trade. One of the remotest sections of all South America, the *Oriente* of Ecuador will long remain a little-known territory (Fig. 239).

THE ECUADORIAN PROSPECT

As a result of the cacao situation, Ecuador faces an uncertain future. The horizon bears no promise of startling development in any new direction. Diversification of products, already under way, will improve conditions, but if cacao drops out completely the country loses a vital crop. Handicapped in numerous respects, Ecuador can hope for no immediate solution of its problems. Even provided that the serious problem of antagonism among classes and political factions were settled, there remain huge obstacles: an almost bankrupt nation; limited areas; unfavorable climate in the portion of greatest natural wealth; a highland zone with favorable climate, distinctly limited, however, by paucity of arable land; inaccessibility and lowly Indian inhabitants. For present purposes, the *Oriente* may be eliminated from consideration (Fig. 240). It has possibilities like those of much of greater Amazonia and similar shortcomings. To Ecuador, the forest resources of the *Oriente* would have considerable attraction, but the almost insuperable heights of the eastern Cordillera are fatal to development. The key to progress for the country as a whole lies in the expansion of transportation facilities in the Pacific Lowlands and in the Sierra. Without means for ready intercourse from one region to another, national problems can never resolve themselves to advantage.

CHAPTER XXXVII

COLOMBIA

Several features in the geography of Colombia are unique in South America. This is true both as regards physical characteristics and economic development. Owing to some of these salient points, the land has had an exceedingly checkered history, at one time being easily the most influential portion of the continent. The progress effected in other republics, however, has far eclipsed that of Colombia —a natural result in view of the tremendous difficulties arising from tropical location, three giant mountain ranges and particularly acute politico-social problems.

Great variety of regions and resources has given the country much of its distinctive economy (Fig. 241). About the seaward margins lie low malarial plains, supplying little to the life of the republic except *tagua* nuts on the Pacific coast, cattle on the Bolívar savannas about the lower Cauca and Magdalena, and bananas at the foot of the Sierra Nevada de Santa Marta. Inland rises the series of titanic corrugations so important in Colombian life; with the included deep troughs of the Cauca and Magdalena Rivers, this region consists of the high western, central, and eastern Andean Cordilleras. Its resources range from tropical rain forests on the lower slopes in a long series of gradations to the cereal regions in the broadest open plateaus, with scattered mineral districts adding considerably to regional activities. This is essentially Colombia, the central highlands constituting the center of agricultural, industrial, and commercial life, and holding nearly all the people. Beyond the eastern range and the elevated plateau about Bogotá, the savannas of the Orinoco and the luxuriant forests of Amazonia stretch for hundreds of miles. Here live chiefly a few Indians, the region contributing very little to Colombian progress.

Such diversity of physical make-up is indicated in the handicap to Colombian transportation. These difficulties have profoundly affected all activities and partially account for many of the factors

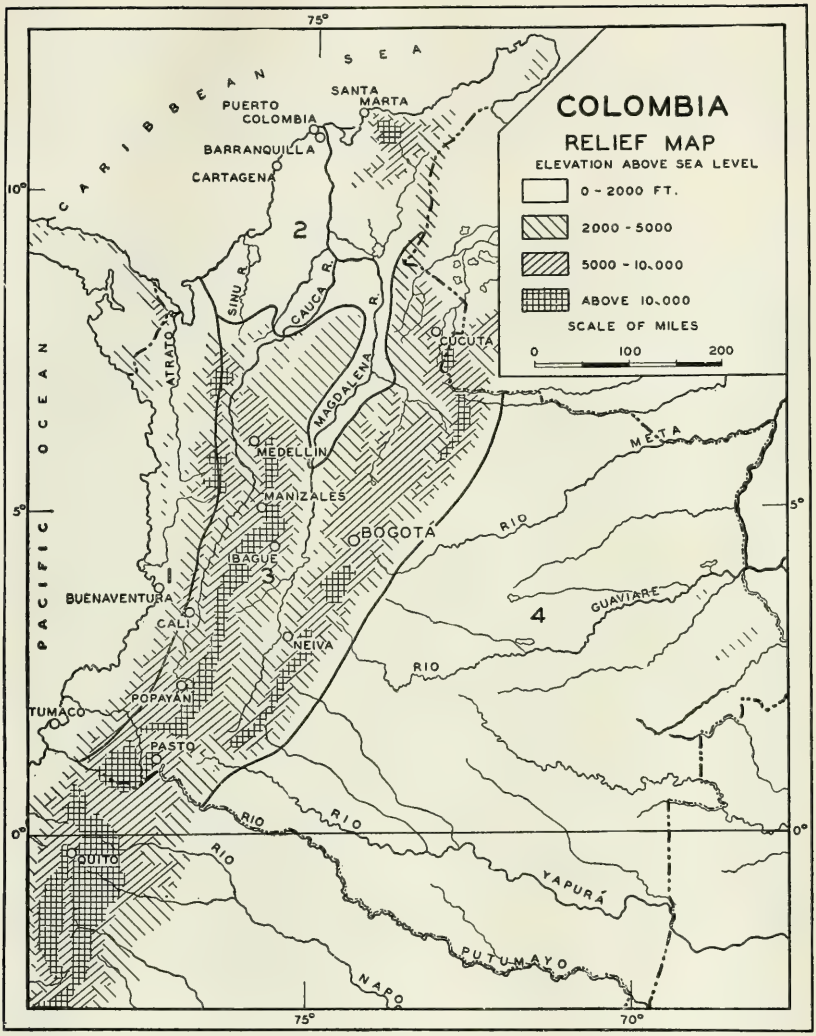

FIG. 241

The major geographic regions of Colombia include: (1) the Pacific Margin and Atrato Valley, (2) Caribbean Colombia, (3) Highland Colombia, and (4) the Eastern Plains of Colombia.

retarding economic advance. Though Colombia alone among the countries of South America has considerable frontage on both Atlantic and Pacific waters, and though it lies nearest to the United States, at the same time its coasts show many disadvantages. In 1,100 miles of coast-line, there exists not one first-class harbor. Even the mouth of its great fluvial highway—the Magdalena River—lies in a frequently submerged zone with offshore sand bars continually making new

FIG. 242. PUERTO COLOMBIA, COLOMBIA'S CHIEF CARIBBEAN PORT

At the long pier which extends a mile out into the Caribbean only 6 ships may load or unload freight at one time; on September 15, 1928, when this picture was taken, 11 ships were lying in the harbor awaiting space at the dock; at most times of the year Puerto Colombia is congested.

obstructions to block the outlets for river, as well as ocean, vessels. On the wet, densely forested, and disease-ridden Pacific coast, conditions are worse, but the vexatious delays incident to shipping on the Magdalena tend to divert a constantly increasing flow of goods to Buenaventura, and away from Puerto Colombia—the Caribbean port handling most of Colombia's commerce.

Though greatly handicapped, natural interior facilities for transportation exhibit a fortunate north-south alignment, thus allowing the two principal rivers—the Magdalena and the Cauca—to assemble the products of the highlands and the valleys over several hundred miles. Nevertheless, the lack of cross-country natural thoroughfares

constitutes a conspicuous short-coming. In the much-interrupted courses of the Magdalena and Cauca lie almost all of the country's important navigable waterways (Fig. 242). Goods moving from Puerto Colombia to Bogotá are about doubled in price by the six unloadings necessary in traversing the 800 miles. The tortuous channel, the countless sand bars, the hidden snags of submerged trees, and the low-water stages of the river at times may delay goods in transit for a year or more. Recently, during one long dry spell, more than 150,000 tons of merchandise accumulated at Barranquilla. Huge quantities too are frequently stranded at up-stream points, lying along the river without warehouse protection, suffering from the heat of the tropical sun, and in some instances submerged in the river (Fig. 243).[1] It is little wonder that the country has had the first and highly successful commercial air-line in South America, providing fast mail and passenger service between the coast and the capital. But moving several hundred thousand sacks of coffee per year requires more than expensive air transport, however efficient.

Owing to the heavy tropical rainfall, rugged relief, long dependence on the unreliable Magdalena, bad politics, local mismanagement, and lack of capital, one of Colombia's most vital needs is adequate railway service. Though the country has an area of 495,000 square miles, it has a smaller railway mileage than Uruguay. Moreover, these 1,500 miles of track are divided among sixteen companies, using three different gauges. The longest haul is only 200 miles, the general scheme being that of short roads leading to the Magdalena, or along its less navigable portions, or tying small producing regions to an ocean point. Recent years, however, have seen an influx of capital

[1] Few boats make the trip without striking several sand bars. In October, 1928, the writer had the following experience on the up-river trip: "All of the fourth day out we were travelling in a dangerous part of the river literally filled with sand bars and snags of old trees. Early in the morning we passed seven freight boats stuck on different sand bars. We were on a light mail boat and were travelling at a very high stage of the water. Whenever the ship slid onto a sand bar, the engineer immediately reversed the engines and slipped off backwards. In one place where the water was particularly shallow we spent two hours in making the distance of a quarter of a mile. The ship struck seven sand bars and repeatedly backed off. In such difficult places two sailors were stationed at the prow of the boat with poles, about 12 feet long; every few feet they would stick the pole down to the bottom and yell up to the Captain the depths of the water. If they yelled 'Aye! Aye!' the boat steamed on, but if the yells changed to '*Ocho, siete, seis* and *cinco*,' the boat slowed down and proceeded like a cautious tiger stalking its prey In this way the fast mail boats usually slip over most of the sand bars during the high-water stage."

interested in developing the railroads; among the most significant of the new developments is that connecting Bogotá to Buenaventura, this to relieve the capital and its region of the almost complete dependence on the Magdalena.

The renewed activity in railroads is paralleled by an ambitious road-building program. Three great groups of highways will foster tremendous development in the three most productive regions of the country. Owing to the mountainous relief, the roads will represent

Fig. 243. On the Magdalena 2½ Days up from Barranquilla

Three boats stuck on sand bars on the chief highway of Colombia; bordering the river are patches of corn, bananas, grasses, and tropical forest. (*Courtesy of the Scadta.*)

an enormous outlay of money, but their numerous advantages far outweigh the question of cost. One in particular may cause a profound change in internal commerce. Known as the "Carretera al Mar," and begun in 1928, it will link Antioquia to the Caribbean coast and effect a great saving in time. While these new roads and railroads represent an effort to meet the country's most pressing needs, huge areas will continue to use the primitive pack-animal transportation prevailing over most of the land. The country's area is great and many producing districts are inaccessible by new routes under development. As for the vast eastern plains, they have little prospect or reason for notable extension of transportation facilities for scores of years.

Population has concentrated in the uplands in order to avoid the unfavorable tropical climates. Routes of trade have added to the influence of climate in peopling the highlands. Thus the area drained by the Magdalena and the upper Cauca has an average of 30 to 60 persons per square mile. This is the largest area of comparatively dense settlement in the Andes, the land holding most of Colombia's 6,600,000 people. Two major districts of concentration have arisen: one on the broad fertile plateau about Bogotá; the other numerous valleys around Medellín. Almost completely isolated by the mountain barrier from intercourse with the heart of the country, the eastern plains stand out in striking contrast to the highlands, for they have less than two persons per square mile and a present importance in keeping with their sparse population.

Another respect in which Colombia holds a conspicuous place among South American countries is that of composition of population. In contrast to the usual situation of two or three major classes, here the variety of regions has permitted four to develop. The white element, composing about 10 per cent of the total, is one of the most progressive in the continent. These live almost without exception in the highlands. Far below them in status are the mestizo masses who make up the bulk of the population, also living chiefly in the more temperate heights. Easy-going, indolent negroes and mulattoes constitute a third and numerous group. They inhabit the coastal regions and river valleys, rarely living in the highlands because of the more rigorous climate. Of pure Indians, there exist three types: the virtually independent tribes of the Goajira Peninsula; the descendants of the aboriginal Chibchas of the plateaus; and the various scattered groups of the eastern plains.

EARLY COLOMBIA

For many years, the lands of present-day Colombia held the reins of Spanish dominion in South America. In response to the lure of tales about fabulous stores of gold, the early adventurers conquered the difficult ranges, subdued the Indians, and founded numerous settlements. As in Venezuela, the earliest settlement was nothing more than a base for pirates who penetrated the interior for slaves. Such was Santa Marta, established in 1525 on the drier portion of the Colombian coast. A few years later (1533), an attractive harbor

affording indirect access to the Magdalena River led to a second settlement, that of Cartagena. The tremendous quantities of gold found near-by and later in the interior led to the establishment at Cartagena of Spain's keystone point of defense. Heredia, who had founded the town, pushed on into the mountains in search of more gold, advancing far up the Cauca Valley.

In the meantime, Pizarro's men had progressed northward from their base in the Ecuadorian plateau. They quickly conquered the half-civilized Indians about present-day Pasto and Popayán and pressed on, founding Pasto, Popayán, Cali, Anserma, and Cartago between 1536 and 1540. The two expeditions met near Cali and then returned to their bases, leaving the forts to strengthen their hold upon the land. A third direction of conquest originated in Santa Marta, whence a band undertook the sizeable task of reaching the reported rich region now known as the plateau of Bogotá. With indefatigable doggedness, the men finally attained their objective. Their terrible hardships had decimated their ranks, but they soon held the advanced Chibcha people in their power, for though the Indians had a civilization almost rivalling that of the Incas they had no military forces. Then, as now, the region was the most densely populated of Colombia, and the conquerors immediately laid the foundations for Bogotá (1538). Forces from Quito and Pasto, as well as from Coro in Venezuela, also arrived on the scene, having been led on by the vision of wealth possibly equal to that plundered at Cuzco.

Soon the adventurers who had spread the rule of Spain over these lands realized the value of the Magdalena River as a thoroughfare and a route was established connecting Santa Marta, Cartagena, and Bogotá. New forces entered the interior to assure continuation of power, and with this, exploitation of the land increased. To work the productive gold mines of Antioquia, the Indians were enslaved, but so fiercely did they fight such subjugation that their diminished numbers necessitated importation of negro slaves whose descendants now people the lowlands. On the plateaus, the Spaniards divided the agricultural lands into vast estates worked by the Indians as slaves. The country, administered under the presidency of New Granada, grew rapidly in power and prestige, for the gold fields produced exceedingly well, and the plateaus proved attractive to Spanish settlement (Fig. 244).

In a few years, however, began the series of political difficulties from which Colombia has yet to free itself. These arose first because of the differences in the natural regions occupied by the three expeditions and the reluctance of the leaders to sacrifice any of their power for the common good. In the second place, here as elsewhere, the burdensome colonial tax system of Spain led to constant and bitter strife between New Granada and the mother country. A third unsettling development was the great power of the clergy, which the colonial viceroys had constantly to fight. In consequence of all these, Colombia's history has been a record of many disastrous struggles.

FIG. 244. ON THE MAIN TRAIL BETWEEN ARMENIA AND IBAGUÉ

As in colonial days much of Highland Colombia still depends upon pack steer, mule, or human porter; much of the coffee and cacao of the region moves from the plantations down steep trails to railways or river ports.

Eventually the enormous taxes placed on New Granada's wheat, sugar, cacao, and hides led to a notable decline in the commerce of the land. Revolution broke out in 1810, and after nine years of bloody struggle against Spain as well as among themselves the lands of New Granada achieved independence. Deeply in debt, and sadly handicapped by the need for better communications, the new country was in a pitiable plight. It continued so for almost all the remainder of the nineteenth century. Revolution after revolution rocked the country, leading to the squandering of huge funds, killing off thousands of men, and irreparably retarding Colombian development. In 1903, the republic received a terrific blow in the loss of its former territory of Panama. This shock seemed to show the Colombian

people the results of their endless strife and in 1904, with the administration of General Reyes, began what might be called the rise of modern Colombia.

MODERN COLOMBIA

Although the revolutions had drenched Colombian soils with the blood of many thousand men, population increased faster than for most of the continent. In 1770, there were 800,000 people, so that natural increase accounted for a considerable growth. In addition, the productive highlands attracted many from Spain, slaves were imported to work the mines and the estates, and many mercenaries hired by Bolívar to fight the Spaniards remained. By 1875, Colombia had 3,000,000 people, and today it holds third place in population in South America.

The tripling of population in the century between 1770 and 1875 accompanied a growth in agriculture and mining, for despite the warring of various factions there remained mouths to feed, and a need for foreign trade to attract capital. Gold held the center of the stage for a long time, composing the bulk of exports far into the nineteenth century. Agricultural products figured only in a small way, but the growth in tillage of land and the productivity of the soil led to the production of surplus commodities. Tobacco, indigo, cotton, and a little coffee were of primary importance. Hides also added to the list, and in later years the collection of quinine bark (*cinchona*) from the forests rapidly expanded. In the last 30 years of the nineteenth century, the foundations were laid for the progress Colombia was to make once political troubles subsided. First, Europe became interested in the aromatic mild coffee of Colombia's mountain slopes. This led to greatly increased production by certain sagacious producers who encouraged a wholesale migration of population. Thousands moved from the plateaus to the interior valley slopes where coffee enjoyed optimum conditions. As a result, producing lands increased in area, new trails were built, and heretofore untouched lands secured contact with the outside world. Coffee accounted for a larger and larger share of the exports, although hides, tobacco, gold, as well as the newer products—platinum and bananas—continued to swell Colombian trade (Fig. 245). Nevertheless, growth in all branches of activity was materially handicapped by the direct effects of the

revolution and by the hesitation of capital to enter so unstable a land.

The apparent guarantees of the Reyes régime ushered in a new era. Foreign capital began to enter, to build railroads, and undertake various other industries; Colombia progressed. In 1907, railway

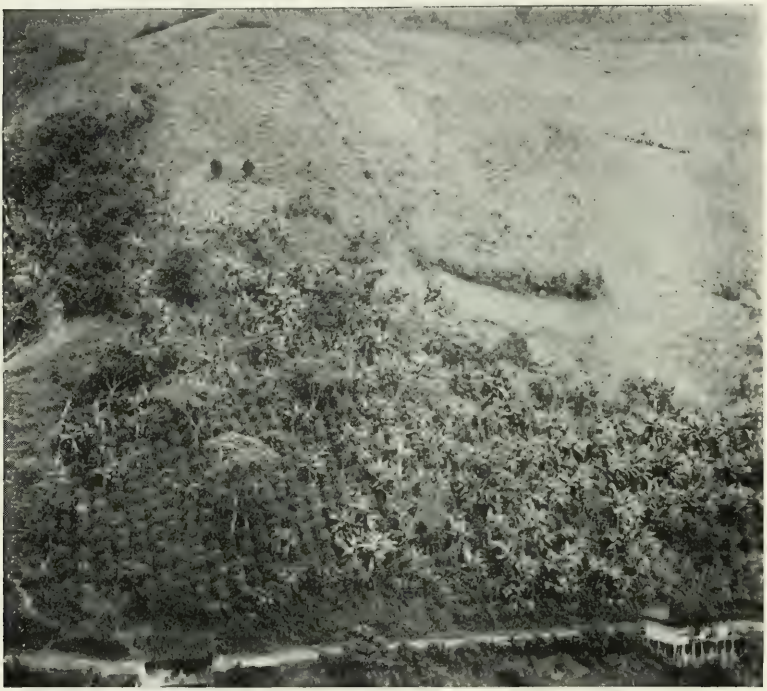

Fig. 245. Coffee "Finca" North of Manizales

The favorable physical conditions for coffee culture in Highland Colombia have been significant in the rapid rise of coffee production in the republic; in the subtropical zone near the upper limit of coffee culture the low, well-pruned coffee bushes require little shade as mist and clouds drift up the steep valleys each day protecting them from the hot noonday sun; *inga* and bananas are here used as partial shade.

service around the rapids between the upper and lower Magdalena was provided; in 1908, the Girardot Railway joined Bogotá and the upper Magdalena (Fig. 246); in 1914, Medellín gained access to the Magdalena by a line to Puerto Berrio, and Cali was connected with Buenaventura, and in 1927 Manizales was connected with Cali. Moreover, national currency was placed on a sound basis and world coffee prices greatly increased. The World War accelerated these

trends and to the constantly growing exports of coffee have been added three new important sources of revenue—platinum in the northwest (now the world's chief source), bananas in the rich lands at the foot of the Sierra Nevada de Santa Marta, and oil in the middle Magdalena Valley. The foreign trade of Colombia is twelve times what it was in 1900!

Each great advance in Colombian development has had as its basis an expansion of transportation facilities, and this still continues as

FIG. 246. BOGOTÁ, THE POLITICAL, FINANCIAL, AND SOCIAL CENTER OF COLOMBIA

Since rail transportation reached Bogotá in 1908 many improvements have produced a modern town in this far-away highland; streets have been paved, tram service, electric lights, telephones, and water systems installed; several good automobile roads lead from the city to different sections of the *sabana*.

the country's greatest need. In view of the exceptional variety of topography, climate, and vegetation, as well as producing regions, the task of providing adequate means is a tremendous one. The flow of wealth into the country, resulting chiefly from the growth of its all-important coffee exports, affords funds for new developments. Colombia is a large country rich in varied resources, lying relatively close to the world's chief markets, and good transportation will open many regions of great potential productivity and facilitate the interchange of commodities between the major contrasted geographic regions.

CHAPTER XXXVIII

THE PACIFIC MARGIN AND ATRATO VALLEY

From the standpoint of physical conditions, the Pacific Margin and Atrato Valley of Colombia are among the two most unattractive parts of the country. Nevertheless, the region produces a considerable amount of wealth, has developed several comparatively large centers of population, and promises to become even more influential, all due largely to conditions of transportation, the presence of significant mineral resources, and proximity to the Panama Canal.

The strategic location of the long strip of land between the Caribbean and the Pacific gave the region an early start. The Spaniards soon recognized the value of the north-south extent of the Atrato Valley and in colonial times that district held a distinctive importance, for despite its unpleasant climate it was a convenient means for reaching the Pacific from the Caribbean, only a low divide separating the waters of the Atrato and the San Juan. From an original settlement at the mouth of the Atrato commercial development gradually extended up the valley to embrace the forests of the region. Farther south no such favorable conditions existed—an extraordinarily dense, and also potentially productive, forest clothing the hilly to mountainous land; thus the south experienced a much later opening, but owing to its fortunate location with respect to serving as an outlet for the interior and to its harbor at Buenaventura, it now has risen to dominance on the Colombian west coast.

The section about Buenaventura and that in the lower Atrato Valley support the densest gatherings of population, though even in those places the peopling is scant; Tumaco in the far south lies in a third and less significant grouping. Buenaventura, now the fastest-growing settlement, has 5,000 people, but because of its utility as an outlet for Highland Colombia it has much importance; its leading exports are coffee, platinum, gold, cattle hides, sugar, and *balata;* the agricultural products come chiefly from the upper Cauca Valley, the minerals from the rich Chocó mines, and the forest products are sent

from many points along the coasts to be assembled and shipped. Among Colombian ports, it ranks second in exports and third in imports. From it railroad and motor roads give access to Cali and the capital of the country; thus it affords the interior a far more dependable route than the Magdalena. The town lies 10 miles from the mouth of the Dagua River, on Buenaventura Bay, and its harbor accommodates vessels drawing 27 feet of water. Improvements in port facilities are intended to make a clean lively center out of this formerly fever-ridden village. As yet Buenaventura has fewer people

FIG. 247. TYPICAL HOMES OF MULATTOES OF PACIFIC COLOMBIA

Small huts and patches of corn, cassava, and fruit trees hardly break the jungle quiet of the vast forest expanse; at the river's edge below each hut is a dug-out in which the head of the family spends a great deal of his time and from which he hooks or spears the chief supply of meat. (*Courtesy of the Scadta.*)

than Quibdó, but promises soon to surpass the interior point. The latter, however, is an important settlement, its location in the Atrato Valley giving it a good position for a barter town as well as for an outfitting point for the gold and platinum miners who work the sands and gravels of the Atrato and neighboring streams. Tumaco, the port of the south, also serves a large interior, but is totally secondary to Buenaventura; coffee, cacao, and *tagua* nuts make up much of its outbound shipping.

The paucity of Indians in the population is noteworthy. So difficult are the climatic conditions that the Indian steadfastly refuses to live in the region, nor can he long resist the diseases which are rife. With the negro the case is different; at Buenaventura, for example,

90 per cent of the population is black. An even higher proportion holds in the mining industries, in which negro men, women, and children engage. These have little ambition and little foresight (Fig. 247). A certain sum of money or quantity of provisions having been amassed, the family falls to consuming it as quickly as possible without the least regard for possible emergencies. Their abodes are miserable thatched huts raised above the ground. Certain of the negroes, as on the northern Pacific coasts, coming little into contact with traders, have fallen into a state of existence akin to that of their ancestors in Africa—gathering a bare living from exuberant nature.

PHYSICAL CONDITIONS

Mountains dominate the coastal scene, but do not rise from the sea throughout the length of the region. North of Buenaventura, a low coastal range reaching a maximum altitude of close to 6,000 feet rises from the sea, and cuts off the Atrato River from the Pacific. Southward follows a coastal belt of flat deltaic deposits made by innumerable streams descending the seaward slopes of the Western Cordillera. The third major physiographic section, the Atrato Valley, consists chiefly of a broad, low, swampy, alluvial plain. The soils of the coastal flats and of the Atrato Valley as a rule are useless for agriculture, but along the coast certain higher portions of the valleys and in the Atrato the natural levees afford fertile strips of soils for some sugar and cacao. Of the valleys leading from the Pacific coast, the Mira and Patia at the south have rolling, well-drained, brown clay-loam soils producing sugar and cacao. The middle San Juan Valley also supports agriculture, though wholly local, on red clay soils of good friability and drainage in a rolling to hilly district.

In contrast to the varied conditions of relief and drainage, climatic conditions, somewhat more uniform, lend unity to the region as a whole. Under the full influence of the tropical sun, temperatures are always high, even on the intermediate slopes of the Western Cordillera. In the low regions temperatures range from 72° to 93° F, promoting a rapid and luxuriant growth of vegetation. Rainfall for the region as a whole is the heaviest in all South America; Buena Vista, near the Pacific coast, records 331 inches a year, and all of the region receives more than 60 inches, the Pacific margin more than 80. No dry season exists, the natives say rain falls every day, and when

FIG. 248. MAJOR VEGETATION REGIONS OF COLOMBIA

Most of Colombia supports a forest vegetation; unforested areas include the arid Goajira Peninsula, the Bolívar and Llanos Savannas, the Upper Cauca and Magdalena Valleys, and the temperate grass lands and *páramos* of the high regions; mountain forests include forests of the subtropical and temperate zones. (*Courtesy of Frank M. Chapman and the American Museum of Natural History.*)

the sun shines it makes of much of the area a steaming comfortless land, unhealthful to an extreme.

Under such conditions of temperature and rainfall, the exceptional luxuriance of the forests covering practically all of the region is easily explained (Fig. 248). The low, swampy, coastal and deltaic plains support dense mangrove swamps. Except for coconut palms, few other trees invade these stretches. From the stands of mangrove to the Andean subtropical zone, around 5,500 feet, the region supports a verdant tropical rain forest, rich in species, generally dense in stand, and providing many of the products of the region. In addition to tropical hard woods are jungles of tall bamboo supplying the materials for negro huts; the coconut palm; the *Phytelephas macrocarpa*, producing *tagua* nuts; the rubber tree (*Castilloa elastica*); the *toquilla* palm (*Carludovica palmata*), furnishing the fiber for the Panama hat; the *ceiba*, or the silk-cotton tree, yielding kapok; bananas, plantains, mangoes, breadfruit, cacao, coffee, and other fruit trees.

PRODUCTS OF INDUSTRIES

Forest Industries.—Though the wealth of natural vegetation would suggest a well-developed industry devoted to the gathering of forest-products, the region is surprisingly deficient in this respect, owing largely to its small population but more to the competition for labor given by gold and platinum. Everywhere extends the thick green mantle of tropical rain forest, a drenched wilderness in which the life of a forest-worker is beset with difficulties. While the region lies near the sea, the rolling to mountainous topography prevents any large exploitation of timber resources. Here, as in more remote South American forests, the principal products must be those which lie near the sea or are easily assembled and transported, frequently on the backs of the negroes; therefore, *tagua* nuts, *balata*, rubber, and a little chicle form the list of leading forest products.

Most of the *tagua* nuts come from the Atrato Valley and from the coast north of Buenaventura, where the negroes bring canoe-loads of cleaned nuts to the coastwise traders and receive in exchange various goods. Though the industry scarcely approaches that of Ecuador, the abundance of *tagua* palms gives it considerable significance (Fig. 249).

Both *balata* and rubber have great possibilities in the region, but as yet production remains small. The principal area is that of the

Chocó in the lower Atrato Valley, where a good part of the output comes from cultivated plantations, one of which contains 160,000 trees. The district inland from Tumaco, in the far south, is also one producing a quantity of rubber. Both the lower Atrato and the Tumaco sections are severely handicapped by labor conditions, the forest negro bestirring himself to tap rubber only with much trouble and then he remains completely undependable.

Additional forest products include chicle, balsam of copaiba, and various medicinal types, most of which come from the lower Atrato

FIG. 249. DRYING "TAGUA" NUTS

A scene in Cartagena, where large quantities of *tagua* nuts from the Atrato Valley are being dried and prepared for shipment.

and Sinú Valleys, where labor is relatively abundant; in the middle Atrato there is also an insignificant amount of lumbering, three or four mills finding operation possible because of the navigability of much of the river.

The output of all these secondary products is small and labor-conditions plus market competition will keep it so. A minor quantity of *toquilla* fiber also is gathered, but the Panama hats, for which it is intended, are made farther in the interior by the more diligent Indians.

Agriculture.—On an organized basis, agriculture scarcely exists in the region. Small quantities of sugar and cacao come from the Mira, Patia, and Dagua Valleys, but the unhealthful climate throttles attempts to keep large sedentary groups on plantations. Corn, sugar, and plantains, supplemented by fish and the fruits of the forest, make

up the food of the negro. A few hills of corn, a stalk or two of sugar and some plantain shoots stuck in the ground, and he has food aplenty for his wants. With these the mulatto spends the day lolling in the shade or gliding down a placid stream taking fish. If he has sufficient food for the day he cares not for tomorrow. He desires most to be left alone to enjoy leisure, his greatest luxury. Cattle are rare, only the Patia Valley supporting a few head.

Mining.—Precious metals—gold and platinum—by far yield the greatest amount of wealth produced in the region. So widespread are the auriferous and platinum alluvia that every part of the region feels the effects of the mining industry's attraction for labor. Practically all of the development is placer mining and on a generally small scale. Entire negro families may pan the river deposits in search for the fine particles of gold or platinum which to them may mean the chance for the much-desired leisure. Large-scale operations face many problems, chief among which are the climate and the inferior labor.

Gold.—Practically all of the rivers of the Pacific margin carry some gold; likewise those of the Chocó district. The latter at an earlier day rivalled the Antioquia fields in production, but with the abolition of slavery both here and on the coast, the disagreeable climate caused the fall in importance. In the Pacific area, the principal exploitation at present is in the south in the Timbiquí River, where dredging has gone on for some years.

Platinum.—For many years the platinum mined in connection with gold washing was thrown away as worthless. Today, Colombia leads the world in the production of this valuable metal and all of the output comes from the region including the Pacific margin and the Atrato Valley. The deposits occur throughout the region from the Atrato to the Ecuadorian border, production, however, centering chiefly in the headwaters of the Atrato and San Juan Rivers and in the south along the Patia and its tributaries. The mineral is invariably worked with gold also. Though, as with gold, a large amount of platinum comes from the crude workings of the native, dredging is of considerable importance, general outfits operating continuously. The increasing use of platinum in industry has greatly stimulated production and continued expansion is likely. The World War in particular and the disruption of Russian production gave the Colombian industry its chance; the first dredge was put into operation in 1915.

Although this Pacific region of Colombia now produces almost half the platinum of the world and the possibilities for expansion are great, the industry faces serious handicaps. No railways tap the platinum regions, communication with ports being by pack train over muddy trails, by canoes, and by small river steamers. The whole region is fever-ridden; on some occasions whole dredging crews have died in a few months, so that only negroes, partly immune to certain dreaded

FIG. 250. LEISURELY DRIFTING WITH THE CURRENT

The chief means of transportation for much of western Colombia and Ecuador is by canoe or small river boat; *tagua* nuts, rubber, and other forest products brought on porters from the forest depths move out by the rivers to shipping points. (*Photo by Frank M. Chapman; courtesy of the American Museum of Natural History.*)

diseases, risk their lives in the arduous labor under these trying conditions.

CONCLUSION

Rich indeed is this region in natural resources: fruitful forests, yielding food, shelter, and raw materials for manufactures; fertile soils, producing great returns with little effort; a widely dispersed store of precious metals. Yet it has a strikingly light population and that of a particularly backward type. Most prominent among the factors that contribute to this state is the climate, which makes of the region a fever-ridden, pestilential and totally uninviting land. Widespread improvement of transportation facilities will afford means for better sanitation and the retention of a larger labor group, but even the highland Indian will hesitate long before attempting a permanent

residence in the steaming lowlands (Fig. 250). One section, however, bears every indication of overcoming its climatic handicaps—Buenaventura and vicinity. The Colombian government is making vigorous efforts to rush the completion of a railroad from Bogotá to this port. Even without such an artery, the relief which Buenaventura affords a large interior, by making it possible to avoid the exasperating Magdalena transport, has made it the second exporting point of the country. With the benefits of through communication to the capital of the country and the completion of port works now under construction, this section of the region will witness marked development.

CHAPTER XXXIX

CARIBBEAN COLOMBIA

To Colombia as a whole, the lands fronting on the Caribbean have great significance, not only because of their access to the sea, but also because of their large and varied production of valuable commodities. About the coastal margins lie three important ports which handle the bulk of the country's commerce, while inland the region produces many cattle and considerable crops of sugar, cotton, bananas, and coffee, yields many forest products, and in late years has contributed a constantly increasing flow of petroleum.

In colonial times, the region witnessed the growth of the principal settlement of the Spanish in all South America—at Cartagena. The strategic value of the neighboring areas accounted for this, for the region afforded access to the open sea, controlled trade routes to the Pacific as well as the interior highlands, and within its own boundaries was capable of producing rich harvests. Hence Cartagena was founded in 1533, eight years before Santa Marta had been settled. Following the capture of the rich highlands about Bogotá, Caribbean Colombia gained new importance by its vital connections with New Granada. The coastal cities grew so rich that they became coveted prizes in the eyes of a veritable plague of sea pirates. Despite these troubles, which were augmented by Indian raids, the region sent to Spain ever-increasing quantities of cacao, tobacco, hides, and forest products from its own lands. With the decline of Spanish power and the dismemberment of former colonial units into several independent republics, the relative importance of this portion of the Spanish main decreased. Nevertheless, the region will always constitute an outstanding portion of Colombia.

In view of its lengthy history under white men, the region shows surprising contrasts in its population, certain parts, such as the Goajira Peninsula and the Sierra de Perijá, still remaining the abode of practically independent and stubborn Indians. The lowland plains, however, bear evidence of their long occupation, for they support a

relatively dense population, which is limited considerably by the excessively warm and humid climate; much of this plains area has between 30 and 60 persons to the square mile, concentrated particularly along the major stream courses—Magdalena and Cauca. Owing to the unfavorable climate, the population outside of the ports, except for a few commercial men and landowners, consists of mulattoes and Indians suffering from tropical diseases and living generally with only the bare necessaries of life.

Fig 251. Negro Huts on the Lower Magdalena

For these easy-going people a rather abundant supply of food is at hand; a patch of bananas, corn, and cassava, a few breadfruit trees, and fish from the river provide food for these folk; the thick, steep, thatched roof indicates the heavy precipitation of the region.

The mulattoes constitute the largest part of the population and carry on most of the agriculture, while the Indians, for the most part, form a minor portion of the peopling in particular districts. Only in the Goajira Peninsula, Sierra de Perijá, and in isolated districts in the Sierra Nevada de Santa Marta do they compose the majority of the population; there they refrain from much dealing with mulatto or white. In general, the mulatto element lives in a primitive state, but it thrives far better than the Indian on the heated swampy plains (Fig. 251). A few crops are readily produced, cattle may be had most everywhere, and the great swamps, or *ciénagas*, and the rivers are full of fish.

In all parts of the region and in all economic activities the effects of the Magdalena River as a channel of commerce are felt, an excellent illustration being afforded by the several shifts which have occurred in the relative importance of the area's three ports—Barranquilla, Cartagena, and Santa Marta. Of the three, Barranquilla is by far the largest and also the most recent; its founding took place more than a century after that of Santa Marta and only in the last fifty years has it achieved much significance. Today, Colombia's leading port presents a progressive aspect and has amassed a population of 75,000. In reality, it is not a seaport, for bars at the mouth of the Magdalena block traffic to the city's site lying some 10 miles upstream; the actual port is at Puerto Colombia, some 17 miles by rail, but this is merely a point of transshipment, the customhouse being located at Barranquilla. The latter's chief rival port is Cartagena. This town, which at one time controlled practically all trade on the Magdalena, lost its grip during the days of the struggle for independence, when the *Canal del Dique*, connecting the port with the river, fell into disrepair. Nevertheless, it serves a large region in western Colombia, and by a railroad to the river at Calamar has managed to stage a come-back; it is also the terminus of the oil pipe-line from Barranca Bermeja, 325 miles distant. Though now having only one-third as many people as Cartagena, Santa Marta, with 18,000, also at one time was the first port of the region, immediately following the blocking of the *Canal del Dique*; it still retains its river port, Ciénaga, but its major interests lie near-by in the bananas and coffee of the Sierra Nevada de Santa Marta. Both Santa Marta and Cartagena have fairly good harbors, but Barranquilla profits by its river-side location.

The great river which so closely affects all activity in all Colombia is both one of the region's greatest assets as well as a most troublesome handicap (Fig. 252). While the Magdalena causes the bulk of Colombian trade to gravitate towards the Caribbean coast, at the same time its peculiarities have occasioned some of the most serious crises in Colombia's expansion.

Though Caribbean Colombia shows certain features of unity, as, for example, tropical temperatures except in the higher parts of the Sierra Nevada de Santa Marta, in other ways it readily may be subdivided into several districts. These comprise: (1) the Savannas—

including the tropical savannas of the Sinú, the Bolívar plains, the lower San Jorge, the lower Cauca, and the middle portion of the Rio Cesar; (2) the lower Magdalena Valley—embracing (a) the Caribbean sugar and cotton district, (b) the general farming and grazing districts of the lower Magdalena, and (c) the areas of tropical forests and primitive agriculture; (3) the Sierra Nevada de Santa Marta; (4) the Goajira Peninsula; and (5) the Sierra de Perijá.

FIG. 252. THE CANAL, BARRANQUILLA

Barranquilla is a great transshipping point for the interior from Puerto Colombia; here the Canal is constantly lined with flat-bottom, stern-wheeled boats and flat barges that carry the freight to and from Highland Colombia.

THE SAVANNAS [1]

The savannas of northern Colombia lie in two great regions. One extends from the lowlands along the Sinú across Bolívar to the Magdalena and north to the sugar-cotton district near the Caribbean. The other area lies along the middle Rio Cesar and Valle de Upar southeast of the Sierra Nevada de Santa Marta. Cattle are reared in all districts of northern Colombia, where people live, but most of them graze in these two large regions. In farming areas they serve as the chief draft animals, but on the savannas their principal use is for meat; in both areas quantities of milk, butter and cheese are used. Physical conditions, though falling far short of ideal, and several economic conditions contribute to the dominance of pastoral interests.

[1] Much of the remainder of this chapter is from "Agricultural Regions of South America," by the author, published in "Economic Geography," Vol. V (1929), pp. 400 to 414.

Along the Sinú, San Jorge, lower Cauca, Cesar and smaller streams broad, low, flat pastures suffer from inundation during the rainy season, but support the best grasses during the dry season. From these flats the land rises in broad, low, graduated levels to the more rolling portion of the central part of Bolívar, the area of the largest and most numerous *estancias*. All the savannas have high temperatures. But along the sea and on the rolling lands rather frequent breezes alleviate the enervating heat of the noonday sun. Annual rainfall increases from about 36 inches in the northwest, along the more arid Caribbean coast, to near 70 inches farther south where savanna grades into tropical forest. Along the Cesar rainfall averages more. Most of the precipitation comes in daily showers from May to November inclusive. Sufficient for a good growth of grasses in general, the dry season brings the problems of decreased and less valuable forage and a poor water supply on many *estancias*. Marked variations in amount from season to season occur and cause large losses.

The low, flat lands along the streams grow a variety of native grasses and vast areas of *Pará* and *Guinea* grass, introduced on lands cleared of forests. *Pará* grass does especially well on these water-soaked lands; *Guinea* does better on *tierra firma*. Both are tall bunch grasses and supply excellent forage when young and tender, but like the native grasses become harsh and brittle with the approach of each dry season; yet the ranges do not become parched as those of the Campos of Brazil. They are not especially good fattening grasses. Everywhere in the savannas tall graceful palms and now and then strips or clumps of other trees rise far above the grass cover and provide shade for the panting herds.

The developed savanna areas are those rather near to markets or lines of transport for animals. On the west the Sinú is navigable as far as Monteria, near the southern edge of the grazing area. In central Bolívar, from Chinú to Calamar, cattle move out by coast ports, by the Magdalena or overland to the north, where they are consumed in the cities of this section, in the one modern packing plant of the area at Covenas, south of Cartagena, or are exported on hoof to Panama and the Islands of the Caribbean. Also many move to up-river points on the Magdalena. The San Jorge and Cauca districts send cattle down the river or overland to the Medellín market, 300 miles to the south. The Cesar area has an outlet on the Magdalena

at El Banco, while the Valle de Upar has two outlets: one west by trail to the head of the Santa Marta Railway at Fundación, and the other north by trail to Rio Hacha on the Caribbean. All the *estancias* produce subsistence crops, but cattle on foot, their hides, and the large cakes of white cheese packed on mules or in dugouts provide the only commodities that can be marketed from remote sections.

These lands possess about 2,000,000 cattle and in the northern section, a few sheep, goats, and mules. The cattle consist almost entirely of old creole stock; tall, bony and rough, they do not yield good cuts of tender beef. It requires from four to five years to bring a steer to 1,000 pounds live weight; then he will dress about 400 pounds of beef. Such a steer brings about $40; in the province of Buenos Aires, Argentina, a steer of 1,500 pounds, giving 750 pounds of beef, can be grown in 2½ years and sold for $55. Thus a grower in the Pampa can produce in the same length of time three times as much beef of far better quality and realize nearly three times as much money as the cattleman in this region.

The industry suffers under serious handicaps. Some blooded bulls have been imported, but for the most part they have succumbed in a short time to disease and pest for want of proper care. The animals receive no care; cows, steers, and bulls graze together, the cows dropping their calves in the open. Grazing on large ranges, they may be moved to fresh pasture from time to time. In only a few places are animals corralled at night. Seldom are they dipped to kill ticks, thick in the savannas, or inoculated for protection against diseases, except anthrax. In a region where strong, large steers stand at a premium for draft animals, many cattle killed consist of cows and heifers; in some sections three out of five killed are cows and heifers, greatly deterring expansion.

The cattle-raising sections produce subsistence crops; physical conditions favor a more extensive tillage of some crops, but the meagre transport facilities, small and inefficient population, and lack of a growing market contribute to the permanency of the grazing industry in the savannas.

THE LOWER MAGDALENA VALLEY

This subregion produces a great variety of products and has greatest importance among the subdivisions of Caribbean Colombia.

It has two of the major cities of the region and the great highway. Its most recent product—petroleum—promises to be one of the most valuable of Colombia's exports.

In northwestern Magdalena, central Atlántico and northern Bolívar the cultivation of sugar and cotton assumes the dominant rôle in agricultural activities. However, cattle, goats, and sheep are grazed in different sections, and fruits and vegetables are produced on all *haciendas*. Near towns the growth of a variety of crops supplies local markets.

Sugar.—Grown on most *haciendas* in small patches, sugar yields a low-grade product, *panela*, palatable and nourishing, but full of impurities. The chief sugar fields stretch along the *Canal del Dique* and the Cartagena-Calamar Railway; but only one modern mill at Sincerin exists in the entire region. Here, double crushers, vacuum pans, centrifugals and modern methods produce a sugar of good quality.

A number of conditions favor sugar cultivation: sandy loam to heavy clay fertile soils; gently sloping to rolling surface giving good drainage and soil aëration; sufficient rainfall for cane without irrigation; a sunny dry ripening and harvesting period; and the rather sparse vegetation on land available for cultivation. Cane grows on the same land for years without rotation, fallow or fertilizer; some fields once planted yield 10 to 12 ratoon crops, though with decreasing yields of cane and sugar content. Average yields are low, 20 tons per acre, but yields of 40 tons of cane sometimes result from auspicious seasonal conditions.

Several canes are grown but the chief one consists of *Singapore* cane, a rather small cane, giving fair yields and good sugar content. The fields after planting receive no care, except for chopping out weeds with large hoes or machetes. The culture of cane depends on *colonos*, or renters, who on allotted cleared land plant cane with all supplies furnished by the landowner or sugar company and receive from $2 to $3 per ton for cane delivered at the *Central*. Most of the juice goes into sugar, but much is manufactured into rum, *aguardiente*, and *chicha*.

Disadvantages for cane culture include several cane diseases and insect pests, rather long dry season every year and often protracted droughts, the lack of modern cultivation methods, a shortage of labor, the indifference of people who do not care to work, and the

small size of the market, owing to competition from other sugar areas of Colombia. The canes have to be cut from December to May, since from May on the heavy rains prevent work and the high humidity favors rapid deterioration of the cane. An expansion of cane cultivation may replace in this area some of the imported sugar, but the region lacks the proper transportation facilities to sell in the highland markets in competition with nearer districts.

Cotton.—Cotton sections embrace the low alluvial lands to the east of the Magdalena from Piñón to below Sitioneuva and the flat to undulating lands of Atlántico, and Bolívar north of *Canal del Dique*. Along the Magdalena the brown to black fine sandy loam and clay soils produce good annual cottons as well as the native perennial tree cottons. The other two sections having sandy to heavy clay soils, less precipitation, and a longer dry season specialize in tree cottons. In all sections types are badly mixed. The cotton areas have two well-marked seasons favoring its culture, a long rainy one from April to October when upwards of 30 to 40 inches of rain falls, and a dry one the remainder of the year when only even light showers seldom interfere with the bursting cotton bolls and the gathering of the crop.

Grown in small patches by mulattoes, the cotton receives little care, except in some sections along the Magdalena, where several fields appeared well tilled. Tree cottons, lasting from three to five years, yield one crop each year. Branches of the shrubs often attain a length of 20 feet. Broken down before picking time, only a small piece of bark left holding the branch to the tree, the loss of sap causes the green bolls to open; the breaking of the branches also serves as a pruning. Soft unripe fiber is then picked with ripe and overripe fibers; all kinds may be dirty from having been on the ground. By careless picking as much as one-fourth of the crop may be left in the field. Tree cottons save labor and yield a long rather fine fiber, but they encourage insect pests by providing hiding places for them. Both annual and perennial types yield good fibers, of 1 to 1¼ inches, but they are mixed with types of ¾ inch fibers, making the entire pick of less value than if all the fibers were short and of uniform length. The long fibers are too good for spinning the low counts of 12 to 20, the average of all the cotton spindles of the country. Labor is scarce, expensive and indifferent. No attempt is made to combat pests, to select uniform seed, and grade the cotton. These mixed cottons

cannot enter foreign regions, and internally they compete with cotton from regions having as good physical conditions and a better labor supply.

In a narrow strip along the lower Magdalena is a region of general farming and grazing which sends cattle and hides, cheese, vegetables, fruits, swine and chickens by dugout or steamboat to the markets of all riverside towns. Formerly supporting a medium to heavy forest growth, much of these low and often flooded alluvial lands of fine sandy loam and clay, black to brown, soils, now grow a variety of crops and *Pará* and *Guinea* grasses, luscious during the long rainy season, and not so parched as those on the higher savannas in the dry season. Pastures occupy most of the land because a market does not exist for large quantities of fruits and vegetables; yet for miles fine-looking fields of corn, plantains, and bananas line the river banks, the verdure being interrupted only now and then by an opening containing a single or a group of pole, palm-thatched huts of the docile lazy mulatto or the headquarters and stake corrals of a vast *estancia*.

On these river-bank farms and cattle lands the mulattoes live with a minimum of labor and mental effort. Fertile alluvial soils, with high temperatures, copious rain and much soil moisture yield abundantly without tillage; fresh food, available any day in the year for the picking, includes corn, beans, cassava, mangoes, bananas, plantains, coconuts and others. Patches of corn in several stages of growth border other crops. Plantain and banana shoots used for propagation stuck in the ground need no cultivation; as the fruit ripens the plant is cut down; from the root suckers come forth and bear again and so on for years. Plantains are eaten green in soups, half or fully ripe boiled, fried, or roasted. In sections pork, chicken, and beef supplement the diet, though many people seldom eat meat. As in the savannas low-grade stock receive no attention, yet in sections near a market cheese may be made and sold. Every river steamboat plying the muddy waters gets its meat from a cattle pen along the bank whenever the fresh supply is exhausted. The animals, pulled onto the boat with a rope around the horns, are slaughtered as needed.

With life so easy in this district and leisure the greatest luxury of the self-satisfied mulatto, only the more energetic folk pile their produce—fruits, vegetables, pigs, chickens, and cheese—into a dugout and glide down the river to a town, there to dispose of only a por-

tion of what they have in a congested market, and then to laboriously pole the heavy dugout up the swift current along the bank in the scorching sun and enervating humidity (Fig. 253). Though prolific nature produces much, there exists little chance for a significant development in the face of restricted markets, sparse, and easily satisfied mulatto population.

AREAS OF TROPICAL FOREST AND PRIMITIVE AGRICULTURE

The forest areas of northern Colombia have a large variety of trees and a rather dense stand. They embrace the broad strip of land

FIG. 253. THREE DAYS UP STREAM FROM THE BARRANQUILLA MARKET

The more energetic negroes along the Lower Magdalena market considerable produce in the large cities; after disposing of the fruits and vegetables, they spend days in poling the long dugouts up the river to their homes.

along the northern margin of the Central Andes, across the San Jorge and Cauca basins, far up the Magdalena to La Dorada, the low plains and hills east of the Cesar Valley, and a broad area south of the Sierra Nevada Mountains. The portion of the lower Magdalena basin just west of the banana region consists chiefly of broad mud flats and winding channels bordered by dense mangrove forests, and hard woods on slightly higher ground. Inhabited mainly by mulattoes along the rivers and by backward forest Indians in the remote sections, these areas possess little agriculture. Here and there are small open clearings, where patches of corn, cassava, and a few fruit trees surround the lowly huts of the inhabitants.

The area supports a gathering industry of forest products; but forests vary greatly in composition and economic value. Along the rivers stretch swampy forests of palms and other types of rapid

growths, subject to frequent inundation. The woods, fairly light in color and weight, have been cut. In the swamps west of the banana region the chief activity of the inhabitants consists of cutting wood for steamers and near-by towns. Of special value for local construction purposes in these forest solitudes is the *caña brava* (*Gynerium sp.*) that grows in luxuriance to 15 or 20 feet high and with stems 1 to 3 inches in diameter. On the slightly higher lands and slopes grow the trees yielding the products that are gathered by the forest folk. They include the whole list of those taken in the forests of the Pacific margin: *tagua, toquilla,* coconut, wax, and other palms; *Castilloa elastica* and *Sapium tolimensis,* two rubber trees; *balata* (*Mimusops balata*); the *lirio,* yielding a substitute for chicle; the two balsams; and *Ceiba pentandra,* the monarch of the forest, which supplies kapok. The gathering industry, persisting under the most primitive conditions, will continue in a desultory fashion.

Petroleum.—Like the petroleum developments in Venezuela, those of Colombia have undergone a rapid rise in late years. Although rich indications occur along the coast from eastern Magdalena to the Gulf of Urabá, all production comes from the Magdalena-Santander field where only one company operates. The producing zone lies near the middle Magdalena close to the point where the Sogamoso River flows into the main stream. If the development were forced to depend upon Magdalena River transport facilities, exploitation would be impossible. Therefore, an expensive pipe line was laid to carry oil from the fields to Cartagena Bay. The line represents an enormous investment, but it seems to have been justified in view of both the impracticability of using the Magdalena and the rapidly growing production.

Whereas the first shipment of crude oil was made from Colombia in July, 1926, in 1929 the country produced almost 22,000,000 barrels and ranked second to Venezuela among the oil-producing countries of South America. The company now in exploitation operates a refinery at Barranca Bermeja as well as supporting various branch storage points along the Magdalena, for the availability and convenience of fuel-oil have caused a great shift from wood to oil in the running of steamboats, locomotives, and industrial plants throughout the region.

The increase in production is likely to continue, for the resources are great. A major handicap is the restrictive legislation which ham-

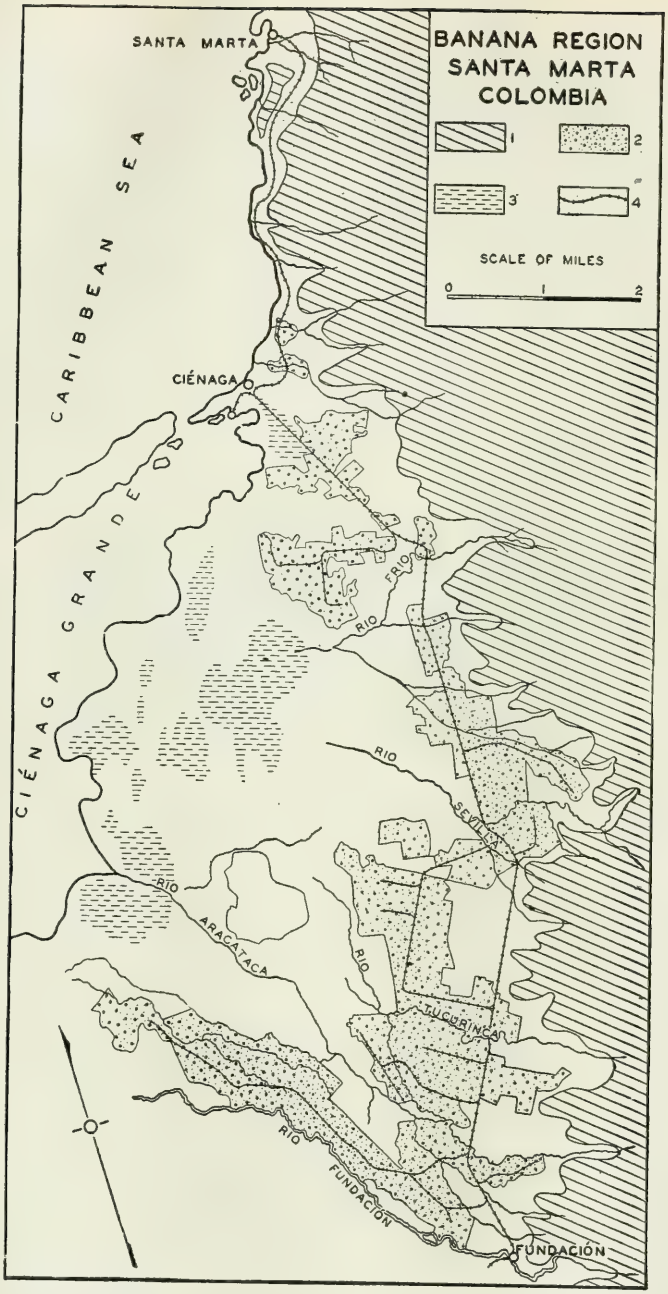

FIG. 254. BANANA LAND OF NORTHERN COLOMBIA

(1) Sierra Nevada de Santa Marta, (2) banana farms, (3) marginal swamps bordering the great *Ciénaga Grande*, and (4) the Santa Marta Railway and branch lines on the banana farms.

pers development, but with modifications which are sure to come about, other fields will enter production on a huge scale.

THE SIERRA NEVADA DE SANTA MARTA

Occupying a triangular area of nearly 6,000 square miles between the Magdalena lowland on the west and the Cesar and Ranchería Valleys on the southeast, the Sierra Nevada de Santa Marta, which rises to snow-capped peaks of 19,000 feet in places, presents contrasted conditions of relief, soil, climate, and vegetation, and consequent human adjustments. Around the lower slopes, the region becomes the leading commercial banana area of South America, and also produces considerable coffee at higher elevations. Owing to the rapid change in elevation in short distances, crops range from truly tropical to temperate in small areas. Though the recent expansion in bananas has transformed life in the district, there still remains a virtually independent group of Indians—the Arhuacos—in the mountain fastnesses. They comprise only two or three thousand and carry on a little intercourse with the lowlands, whence they obtain chiefly sugar; on their own lands they raise some corn and coca, and in the mountain pastures they keep a few head of cattle.

The Banana Lands.—From the salt flats a few miles southeast of Ciénaga, the banana area extends south for about 40 miles on the piedmont plain at the base of the mountains and along the Santa Marta railway. With a deep well-protected harbor, encircled by a curved shore and high islands, at Santa Marta only a short distance away, the banana area has many auspicious physical conditions for banana culture (Fig. 254).

On the broad gently sloping piedmont plain that spreads out for 10 miles or more from the base of the mountains, flow several depositing streams, building up plains of fine sandy loam soils of considerable depth, ideal for bananas when well drained. The important streams, Rio Frío, Sevilla, Tucurinca, Aracataca, and Fundación, provide at no great expense the waters for irrigating the fertile soils; from most any point along their courses water may be diverted to the farms and drained off into the great swamp—Ciénaga Grande—to the west by master ditches cut by hand in the fine alluvium (Fig. 255). On the swampy or higher interstream areas, some of which constitute potential banana land, grow tropical forests or excellent *Pará* and *Guinea*

grasses planted for the draft cattle of the region. The streams, coming down from the high Sierra Nevada, carry a load of fine soil materials and with each irrigation add some to the fields. So productive are the soils that little fertilizer is applied even to fields which have grown excellent bananas for 30 to 40 years. Soils vary from pure sands to fine clays, but those along the streams generally consist of fine sandy, clay loams; the best soils are sandy clay loams with 15 to 35 per cent clay. Soils with more than 40 per cent are too heavy,

FIG. 255. IN THE FUNDACIÓN DISTRICT

The broad, piedmont, alluvial plain consisting of fine, sandy, loam soils provides almost ideal land for banana culture.

have poor drainage, and favor diseases and rot. In all soils the water table must not be within 3 feet of the surface. Banana roots rot when covered by standing water for more than 3 days.

On these sandy loam soils, a dense, tropical, hardwood forest constitutes an obstacle to the establishment of a plantation. To clear, burn, plant and clean until the first crop, one year after planting, it costs about $50 per acre. A hot region, the temperatures of the banana sections vary little from season to season or from month to month. Usually they range from around 72° F at night to 89° F or above in the hottest part of the day. All the mornings and most of the late afternoons are clear and hot giving a large percentage of sunshine, a condition required for the best development of the banana.

Precipitation in the banana section increases from about 35 inches near Rio Frío to 65 inches at Fundación. Most of the rain falls in heavy convectional showers during the early afternoon at two periods: April to June inclusive, and September to November; some years the rains continue through July and August. During the rainy months no irrigation is necessary, but during the dry season the plantations are irrigated about every 20 days. For this there exists a good supply of water, the precipitation at intermediate elevations in the Sierra Nevada being about 100 inches and the rainy season longer, and the higher parts of the mountains possessing large permanent snow fields.

While the rains usually come without much wind, local strong winds wreak havoc on some farms. Though some years are free of winds, most seasons have strong winds in April and May, and September to October, as many as 1,000,000 to 1,750,000 bunches going down each year in the face of the winds.[2] This equals about one-ninth of the total production; but since the worst winds come during the slack market season in the United States the injury does not prove disastrous. The wind trouble is leading to some interesting results in the speeding up of fruiting in some sections by close planting and heavier irrigation.

Possessing much sunshine, high temperatures, and good drainage, the banana fields are peculiarly free from diseases and insect pests. The region does not have the Panama disease, a disease that has all but wiped out the industry in other areas, nor the banana root borer. But it has a scale which causes some loss, since it produces a black spot on the skin, making the fruit unmarketable, though the inside remains in a perfect condition. Fortunately, the chief damage of the scale comes during the slack market season.

Physically one of the finest banana areas in the world, the region possesses also an admirable economic organization for the efficient growth and shipment of the fruit (Fig. 256). Here private growers, who sell to the fruit company, have 20,000 acres of land in bearing. The United Fruit Company holds a lease on nearly 100,000 acres of land of which 30,000 acres are in bananas, and nearly 10,000 in pastures and other improved land; the company extends the plantations at a rate of 1,500 acres per year with the gradual increase in consumption, and with the abandonment of small areas where salt water has

[2] The wind on August 22, 1929, blew down nearly 7,000,000 bunches.

come in the old Rio Frío district, where the soil is too heavy, or where the water table is too high. The company's holdings, divided into forty farms in the several districts, require some 10,000 laborers, who make, by piece work, from $1 to $1.50 per day, 160 foreigners and 5,000 head of cattle for draft, beef and milk. All the laborers consist of negroes and mestizos; they are affected by the tropical climate of the banana area, subject to malaria, and are anemic to a considerable extent.

Once a banana plantation is established, which includes diking of the main river, clearing and burning of the forest, planting, cleaning

Fig. 256. Carting Bananas from Plantation to Railway Siding

to the first crop and digging the drainage and irrigation ditches, the fields require little attention. About every two months the weeds are cut with a surface shovel and piled between the bananas. The soil needs no cultivation as it is so loose and friable. After a plant bears a bunch, it is cut and piled with the weeds to rot. New sprouts grow and yield, one after another for five or six years, when the old and rotten root system is uprooted. A new planting between the old rows, where weeds and banana stalks have decayed, starts the cycle all over for six more years.

So well organized and coordinated are the cutting, packing out to cart lanes and railway sidings, and shipping by rail to Santa Marta

that 160,000 bunches from company and private farms can be put onto a ship in 15 hours; a 'phone call from the manager in Santa Marta starts in motion the hands and machinery that deliver this huge quantity of fruit in a few hours, with only a slight shortage or a small overcut (Fig. 257).

A result of favorable physical conditions, marked increase in consumption in middle latitudes, a decreased production in other regions, efficient activities of the fruit company, and freedom from export duty and taxation, the shipments of bananas from the Santa Marta region increased from 70,000,000 pounds in 1908 to more than 500,000,000 pounds in 1926; in recent years winds have reduced the yields materially. The industry, so far as available land is concerned, is capable of marked expansion.

In contrast to the excellent methods of banana production, subsistence crops, including corn, cassava, and beans, show primitive conditions. Planted in small scattered patches cleared of brush and unplowed, these crops receive no attention except for chopping out the larger weeds with the machete. The only implements used in the region include the machete, shovels, hoes, and axes. But on the cattle estates of the fruit company better methods prevail. Much has been done to provide good pastures of *Pará* and *Guinea* grass, to regulate breeding, to improve the stock, and to restrict the ravages of insects and diseases.

The Coffee Plantations.—In the valleys on the north and western slopes of the Sierra Nevada de Santa Marta, from 3,000 to 6,000 feet elevation, are a number of fine coffee plantations and many small *fincas*. Together they contain 6,500,000 bearing trees, two-thirds of which are young trees entering the prime of productivity; but this number represents less than 2 per cent of the bearing trees of Colombia. Here, on the steep slopes, the *guamo* (*Inga vera* and *I. sapida*), a legume with a tall slender white trunk and bushy crown, partially shades the closely growing coffee bushes beneath.

One of the best coffee regions of Colombia, the Sierra Nevada possesses several advantages: (1) steep slopes providing good drainage in protected valleys having little or no strong wind; (2) deep fertile soils; the top layer consists of dark brown clay with much humus; the subsoil for several feet in depth is heavy red clay high in iron and potash. These soils seem to resist erosion remarkably even on steep

FIG. 257. SANTA MARTA, COLOMBIA
(*Courtesy of the United Fruit Company.*)

slopes and under heavy precipitation; (3) almost ideal temperatures ranging from 60° to 80° F; (4) annual rainfall amounts to 50 to 70 inches, most of which comes as noonday or afternoon convectional showers from April to November inclusive; no heavy downpours in March and April interfere with proper flowering; (5) much sunshine even during the rainy season promotes good growth; (6) a long dry ripening and harvesting period facilitates gathering and preparation of a good quality coffee; (7) the region is peculiarly free from diseases and insect pests; (8) transportation to the port of Santa Marta for only one cent per pound represents an insignificant item compared to the transport cost of coffee from Antioquia to the Caribbean.

The region possesses admirable physical conditions in a good location near the sea, but it suffers from a shortage of labor, resulting from sparse population in the hills, good wages paid by the United Fruit Company, favorable living conditions provided by that organization, and the ease of life on the lower slopes where Indians may live without much work. Most of the labor on the coffee plantations consists of mestizos and Indians, who make by piece work from $1 to $1.25 per day, well above the average of 50¢ to $1.20 per day for all Colombia. Laborers come in from across the Magdalena and even from the West Indies Islands during the chief harvest period from the first of November to the first of January; a second harvest comes in March and April.

Plantations once established require a minimum of work except at harvest time; in this district, owing to the cost of labor, coffee trees are not pruned back; they grow to 12 or 15 feet in height, often breaking over under the weight of a good crop. But the dead wood is cut out every year or two. Fields weeded once with a hoe and twice with a machete each year get no other cultivation. The close shade of the trees retards the growth of weeds and grasses (Fig. 258).

Favored by physical conditions, a marked expansion of coffee culture in this region awaits the opening of good mountain trails and an increase in the labor supply.

On the coffee plantations, as subsistence crops, corn, cassava, potatoes, bananas, grape fruits, oranges, and other fruits are produced; as in the banana region they receive little attention. Corn serves as the first crop on cleared and burned land being prepared for coffee. In this zone many stock of low grade are kept for meat, milk

FIG. 258. COFFEE MILL, CINCINNATI ESTATE

On the hills back of the mill are the coffee trees well shaded by *inga* trees; water for running the mill and washing the coffee comes down the steep slope through the pipe at the back of the mill; through the light-colored pipes leading to the upper part of the mill coffee is flooded down from the high hillsides.

and draft. The pastures consist chiefly of two planted grasses, *Yaragua* and *Maquia*. *Maquia*, more of a turf grass than *Guinea* grass, keeps weeds from growing and serves as a fattening grass; it does not dry up like other grasses and thus favors a good yield of milk.

Outside the coffee and banana zones subsistence agriculture prevails in patches throughout the Sierra Nevada de Santa Marta. From tropical climes to *páramo* backward Indians gather a variety of crops upon which they bestow little or no care and graze a few animals per family on forest clearings kept from tree invasion by periodical burning. Living in low adobe huts of one or two rooms covered with thatch, they produce the bare necessaries of life and no more. Though the Sierra Nevada de Santa Marta supports a verdant tropical forest in the lower reaches, and temperate species in the higher por-

tions, owing to a sparse population of backward Indians, and poor mountain trails, there hardly exists a forest-gathering industry as in other portions of northern Colombia.

THE GOAJIRA PENINSULA

To the east of the Sierra Nevada de Santa Marta stretches the Goajira Peninsula, which embraces a territory of more than 5,000 square miles, almost as large as its neighbor to the west. Chiefly a low-lying region, it rises in broad sandy steps from the Caribbean coast. Sparsely inhabited by Indians living in a backward state and often in semi-nomadic tribes, who gather sustenance from xerophytic forest of cacti and thorn bush and a few goats, the region produces little in the way of farm or pastoral products. Some fertile valleys exist and water is available, but irrigation is practically non-existent.

Always hot, though tempered by the refreshing Caribbean breezes, the peninsula receives less than 35 inches of rain per year. For half the year, from December to June, a parched desert land, it receives less than 4 inches of its annual quota. Then man must turn to the sea or wander with his animals to find sustenance, and vegetation adopts all xerophytic characteristics at its command to live over the period of desiccating drought. In the center of the peninsula some considerable areas of savanna lands with a short grass (*Aristida*) may be used in the short rainy season but must be abandoned at other times; in the southwestern part of the peninsula some large pastures of *Guinea* grass exist, but they suffer in the dry months.

The chief wealth of the region rests in its goat herds, which supply meat and milk for the inhabitants and skins for export, in its xerophytic forests, and in its horses from the pastures of the Rio Hacha Valley, the best portion of the region. The forest materials of note include the pods of divi-divi (*Caesalpinia coriaria*), the pods of *algarroba* (*Prosopis campestris* and other *sp.*), and the fibers of the leaves of *Furcraea macrophylea*, a species covering large areas in the Rio Hacha area. The divi-divi with a broad branching crown, sparsely scattered over all the arid sandy wastes, produces many pods that yield 40 to 50 per cent tannin. The pods of the *algarroba*, also rich in tannin, yield a high-grade product for tanning fine grades of leather. The seeds of these trees supply a needed article of diet in this arid region.

Though a few fertile valleys exist in the southwestern portion, the

region as a whole can advance little in agricultural activities. Its inhabitants must strive hard to eke out a living on the sandy wastes from goat herd and from cacti, thorn-bearing bushes, and other xerophytic forms.

SIERRA DE PERIJÁ

East of the savannas and forests of the Cesar and Hacha Valleys rises the Sierra de Perijá, a rugged mountain region occupying more than 6,000 square miles. The western range, continuing north from the Sierra de Ocaña, contains peaks from 9,000 to 10,000 feet; eastward several ridges decrease in elevation to near 2,000 feet in the easternmost one that drops off rapidly to the Maracaibo lowland near Machiques. Throughout much of its extent it consists of a wild country, uninhabited over vast stretches and possessing little game, or inhabited by small uncivilized Indian tribes at war with each other a great deal of the time. Not a single well-travelled or known trail crosses the entire region.

Though well within the tropics the moist heights have variable temperatures; the steep humid slopes with a heavy deep terrain support a dense tropical rain forest, while in the thin soil areas on the crests of the ridges, shrubs, giant ferns and wiry grasses replace the forests.

Where Indians dwell in pole-thatched huts, primitive forest agriculture is practiced in small clearings or burned areas. The Indians grow, without any tillage, yams, bananas, plantains, corn, and cassava; they keep a few chickens and swine, but other animals are not present. Inhabited by forest Indians, who desire to be left alone and remote, little development may be expected in this little-known area.

THE FUTURE

The great variety of Caribbean Colombia's produce tends to give the region an economic stability lacked by other parts of the country. Nevertheless, these lands face two very vital problems in the way of expansion. The first concerns climate. As a whole, the region suffers from a particularly unhealthful climate, most of the natives suffering from malaria or tropical anemia; sanitation is in a rudimentary state. Though the ports have developed certain industries, such as the textile activities at Barranquilla, this has been possible because of the large immediate markets; continued industrial progress is blocked by

a climate discouraging factory labor. Second of the regional difficulties is transportation—the Magdalena River. While a large part of Caribbean Colombia's production goes out of the country, a considerable quantity also goes inland, thus necessitating a trade route of dependability; moreover, the ports owe their development largely to their rôle as points of shipment to and from the interior. Improvement of the river is becoming more and more necessary, and greater possibility exists for some progress than in the case of climate and sanitation. Through rail communication might help, but the expense would be prohibitive. As it is, the region and the country as a whole will continue to suffer materially from the vagaries of their one great highway.

CHAPTER XL

HIGHLAND COLOMBIA

Though Highland Colombia embraces only one-fourth of the country, it is by far the most important part of the republic. It harbors a large portion of the 6,600,000 people and nearly all of those where the European element dominates; it has the largest comparatively densely settled area in the Andes, a density of 30 to 60 persons per square mile on the flanks of the Eastern and Central Cordillera. The region harvests nearly all the coffee of the country, produces most of the minerals, in spite of rugged surface has most of the railway and road mileage, and makes nearly all the manufactured wares of the nation. That an extremely rugged highland area, removed from the sea, should so completely dominate a nation indicates the significance of a highland environment in the tropics. To its varied environment the people of the region owe their health, wealth and progressive tendencies, so lacking in the Pacific Margin and in the vast eastern plains.

A VARIED ENVIRONMENT

Few areas in the continent exhibit in a small extent such sharp contrasts in terrain, climate, native life, population, and activities. At places are broad, dry but fertile valleys with lazy mulatto or negro; at others hot gorges with only cacti and thorny bushes; on the steep humid and fertile slopes the deep green of the coffee *fincas* carefully tilled by the industrious highland mestizo; on exposed rainy slopes the dense subtropical and temperate forests with only a sprinkling of people; higher up clothing many a steep slope the patchwork of temperate cereals garnered by struggling highland Indian; verdant grassland slopes and summits dotted with the huts of the pastoralist; the cold cloudy *páramos* with their heath-like and resinous plants and *ichu* grass; and above all the eternal snows of the towering Cordillera. In physical and economic structure, Highland Colombia has no counterpart in the continent.

Relief.—From the massive mountain knot of Pasto, near the southern border of Colombia, three majestic ranges, extending to the north and separated by the Cauca and Magdalena Valleys, form the framework of Highland Colombia (Fig. 259). Complex, high, rugged, and capped here and there by towering volcanic peaks, the Western, Central, and Eastern Cordilleras provide the variety of conditions basic to the importance of the region. These ranges, in contrast to those in the Andes farther south, enclose few high broad *pampas* or plateaus. For the entire area few level stretches of any extent exist and they do not constitute the chief agricultural lands. The western part of the region is marked by the bold high Western Cordillera, affording few low passes. This range drops off sharply to the broad Cauca Valley. From its rolling to flat surface the land to the east rises rapidly in places in rounded hills and in others in steep valleys to great heights in the Central Cordillera, a north-south backbone with peaks rising to more than 18,000 feet. The Upper Magdalena has stretches of level lands, but mountain spurs come to the river's edge in many places. In the broad Eastern Cordillera a few high plateaus or savannas afford stretches of level land.

Temperature Zones.—The great heights to which these ranges rise produce within 8 degrees of the equator almost every temperature zone of the globe. No one can struggle on mule back for days and weeks up and down the Andean bulks and stand on the crest of a range and not realize that temperature, as influenced by altitude, is obviously the dominant factor in producing the major zones of native vegetation, fauna, and cultivated crops. Yet precipitation, humidity, soil, and ground water modify a simple altitudinal zonation. However, four temperature zones [1] based chiefly on decreasing temperatures with altitude include (1) the tropical zone, up to near 3,400 feet, where the mean annual temperature is from 83° to 75° F with little range from month to month; (2) the subtropical to temperate slopes and valleys from 3,400 to 6,800 feet or thereabouts, with mean temperatures of 75° to 63° F; (3) the temperate lands of high plains and mountains from 6,800 feet to near 10,000 feet, with mean tempera-

[1] These zones correspond roughly to *Tierra Caliente*, *Tierra Templada*, *Tierra Fría*, and *Páramo* of other authors. Using isotherms as zonal boundaries, Hettner, in "Kordillere von Bogotá," p. 70, places the upper limits of the *Tierra Caliente* at 1,000 meters; the *Tierra Templada* between 1,100 and 2,000 meters, the *Tierra Fría* between 2,100 and 3,000 meters, and the *Páramo* between 3,100 and 4,000 meters.

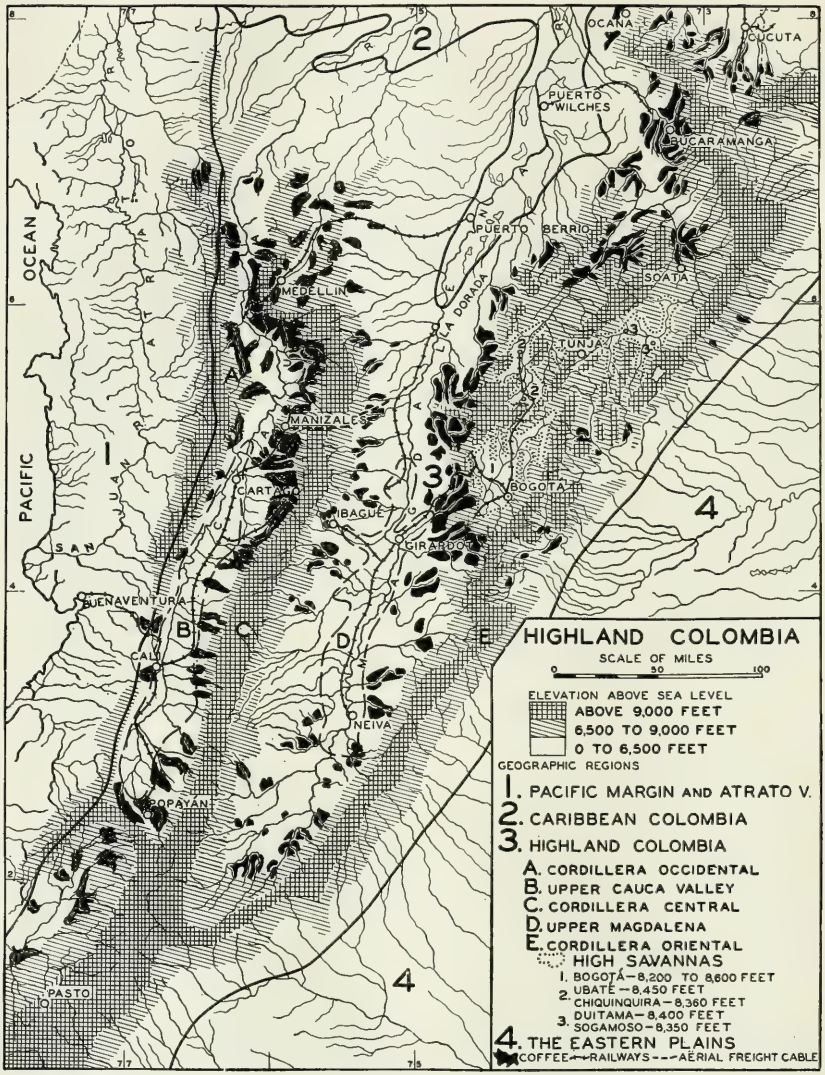

FIG. 259

The major regions of Highland Colombia include: the Western Cordillera, the Cauca Valley, the Central Cordillera, the Upper Magdalena Valley, and the Eastern Cordillera; the chief coffee districts lie on the western flank of the Central and Eastern Cordillera and in the mountains southwest of Cúcuta.

tures from 63° to 50° F; and (4) the *páramos* between 10,000 feet and 14,100 feet, cold windy regions all of the time.[2] A significant condition is that in a region within eight degrees of the equator nearly one-third of the area has a temperate climate.

Precipitation Belts.—Corresponding with relief, altitude and exposure, precipitation varies as much as temperature. Exposed slopes at intermediate elevations receive large amounts in heavy convectional showers. Deep, narrow sheltered valleys and lowlands receive almost none, exhibiting desert-like flora. There are two rainy seasons, at the time of maximum elevation of the sun, separated by two seasons of little rain. But exposure and altitude cause large contrasts. The eastern slopes of the Western Cordillera and the flat floor of the Cauca Valley, exhibiting dry conditions, receive from 30 to 50 inches of rain per year. The western flank of the Central Cordillera from Medellín to Popayán, at 4,000 to 7,000 feet, receives a rather heavy precipitation, from 45 to 75 inches and possibly a little more in places. High exposed slopes may receive as much as 120 to 140 inches. Contrasted precipitation conditions modify considerably the simple altitudinal zonations of vegetation and crops. Forest belts may be 2,000 feet higher on the dry leeward slopes than the same type of forest on a windward moist slope where the temperatures are not essentially different. In precipitation the Upper Magdalena presents a close parallel to that of the Cauca and the bordering ranges. Within the eastern range the broad savannas and basins receive a medium amount of precipitation; Bogotá (8,727 feet) 40 inches. Higher up the cold Andean heights, though damp and rainy much of the time, receive an annual total less than intermediate elevations.

Vegetation Zones.—Corresponding to temperature, precipitation and terrain, the following generalized vegetation zones may be recognized:

Tropical zone	sea level	to	4,000– 6,000 feet
Subtropical	4,000– 6,000	to	8,000– 9,000 feet
Temperate	8,000– 9,500	to	10,000–12,500 feet
Páramo zone	10,000–12,500	to	snow line from 13,000–15,000 feet.

[2] Typical temperatures of the *páramo* observed at 10,500 feet were 48° F at 6 A.M. and 64° F at 1 P.M., the nearest to minimum and maximum; at 9,500 feet in another place temperature ranged between 48° and 62° F; at 13,000 feet they dropped each night to 27° F and rose to 57° and 60° F shortly after noon.

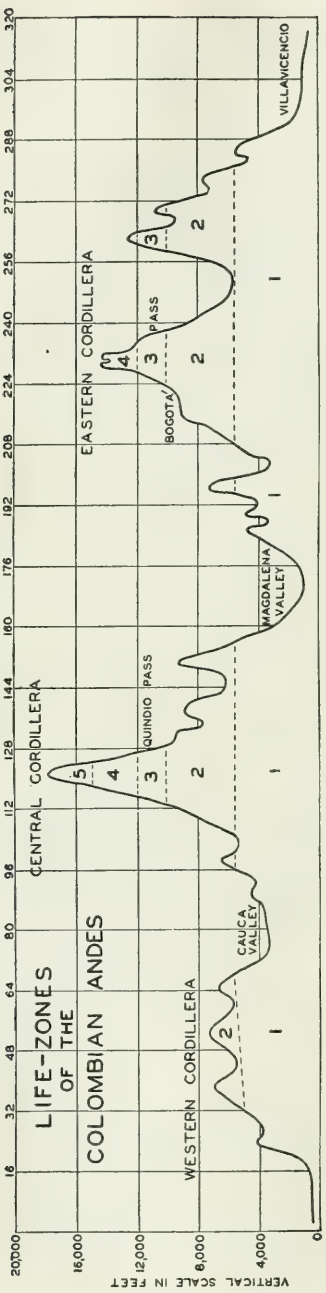

FIG. 260

A semi-diagrammatic profile through the three ranges of Highland Colombia from the Pacific to the Eastern Plain: (1) tropical zone, (2) subtropical zone, (3) temperate zone, (4) *páramo* zone, and (5) region of perpetual snow. (*After Frank M. Chapman.*)

The altitudes at which these zones are found vary considerably with latitude, exposure, and soil characteristics but within eight degrees of the equator they may be accepted as fair approximations to the truth (Fig. 260). Cacao drops out around 2,000 feet, bananas and sugar cane around 5,000 to 6,500 feet and coffee around 7,000 feet (6,000 feet in the Sierra Nevada de Santa Marta).

Striking contrasts of precipitation and temperatures show similar contrasts in crops and vegetation. Numerous low, small, sheltered valleys within the region have desert-like flora; two large areas of tropical semi-arid vegetation include the Cauca and the Upper Magdalena Valleys. Here forests are restricted to the banks of streams and low-lying areas; grasses and bushy growths show plainly their adaptation to drought. Elsewhere at low elevations in moist places are true tropical hardwood forests. Subtropical forests include many tropical species as well as tree ferns, oaks, walnuts, and the *Inga*, the valuable coffee shade tree. This subtropical for-

est, where plenty of moisture is available, higher up grades into a temperate forest. In the drier places of the temperate climes, grasses, cereals, and root crops replace the forest bands. Higher up are the bleak *páramos*, areas of hardy grasses, mosses, ferns, the wholly *Espeletia*, and some sprawling shrubs. Belonging to the better temperate grasslands are the intermontane savannas, the most important of which is the *Sabana de Bogotá;* its vegetation consists chiefly of temperate grasses; only two trees, an oak (*Quercus Humboldtii*) and

FIG. 261. THE MAIL FROM PAMPLONA TO SOATÁ

Under heavy armed guard the mail from major towns in the Eastern Cordillera moves for days on mule back; a highway now being constructed between these two points will improve transportation conditions greatly.

the eucalyptus, being present in numbers; the latter tree, introduced several decades ago, lines the farms, fields, roads and even the streets in the villages on the savanna.

Transportation Facilities.—Highland Colombia has most of the highways and railroads of the country, yet much of the region depends upon primitive means of transport—upon pack steer, mule, or even human porter (Fig. 261). The region has outlets through three channels: one by way of the troublesome Magdalena, the chief artery of trade; one by way of the railway and the Pacific port of Buenaventura and a third by way of the Catatumbo and Lake Maracaibo. The lower portion of the Cauca Valley and Antioquia have direct rail connections with the Magdalena at Puerto Berrio. The auto road

over the Central Andes between Ibagué and Armenia connects the rail system of the east with that of the Cauca and the Pacific. Thus the larger centers of the region have rail, road or river connection with the outside. And these improvements mark only the beginning. As the "Carretera al Mar" may cause a profound change in parts of Antioquia, the road under construction from Bogotá to Cúcuta will break the isolation of many productive valleys and arouse whole communities from centuries of peaceful repose.

REGIONS OF HIGHLAND COLOMBIA

The north-south arrangement of the major physiographic features and the altitudinal alignment of temperature, precipitation, vegetation, animal life and peoples produce contrasted regions of exceeding complexity in Highland Colombia. From west to east these regions comprise: the Western Cordillera, the Cauca Valley, the Central Cordillera, the Upper Magdalena Valley, and the Eastern Cordillera.

The Western Cordillera.—The lowest and least continuous of the three great ranges has the smallest population and is the least developed. That this should be so results not from isolation, as it lies nearer the great Pacific highway than any other region. Bordered by the hot, rainy, steaming forests on the west, its inherent geographic conditions account for its failure to foster development.

From the Pasto knot the Western Cordillera extends due north for several hundred miles, rising almost like a wall from the Cauca trench. Near the border of Ecuador two peaks, Chiles (15,680 feet) and Cumbal (15,710 feet), are capped with perpetual snow. The range attains an altitude of 12,600 feet in the central portion; northward the ranges diverge and decrease in elevation between the Sinú and the Atrato. The Western Cordillera does not have great igneous cones north of the Pasto group, but it resembles the other great ranges of Colombia in general structure—a backbone of crystalline rocks underlying extensive Cretaceous formations. The system, broken and rugged, consists in places of several separate ranges rising to 9,000 and 10,000 feet and separated by valleys whose floors lie 2,000 to 3,000 feet below the crest. Outliers of the main range stand out 5,000 feet above a basal elevation of 3,000 feet. Of great significance to Highland Colombia is the one great break in the range between Cali and Buenaventura, where the railway scales the divide at 5,250 feet.

Dropping off rapidly towards the west, the slopes of the Pacific Margin are clothed almost everywhere with a dense tropical, subtropical or temperate forest, even to the crest of the ridges. Here the high humidity, rank and rapid growth of vegetation in the lower elevations and insects do not favor human habitation. The subtropical and temperate belts with a thick stand of trees, almost a solid mass of ferns, creepers, and epiphytes burdening every tree trunk and branch, and with a high percentage of cloudy days (the upper belt of forest is known as a cloud forest) exert a similar repelling influence. In the south and between 5° and 7° N. latitude are stretches of true *páramos* sparsely peopled. Within the ranges deep valleys show arid growths. In contrast to the western flank, the eastern slope below 6,500 and 8,000 feet, throughout much of the length of the range, supports a dry thorn-bush forest. However, in ravines and moist places strips of forest extend down almost to the banks of the Cauca. The higher forest zone gets lower and lower towards the north until it reaches the Cauca in latitude 7° N. No broad savannas offer forage for animals.

Extremely rugged, humid and forested on the west, hot and dry on the east and without large mineral resources, so far as known, the Western Cordillera supports few people. The whole area has a density of only about 2 per square mile, a striking contrast to other portions of Highland Colombia. Not a single large city lies within the region. Only small stagnant towns of a few thousand people walled in by steep mountain sides or almost impenetrable forests have contact with the outside only over treacherous mule trails. On the western flank in the south a few valleys produce cacao, and a little coffee for export. Elsewhere the forest reigns supreme, patches of subsistence crops surrounding the crude huts hardly breaking the deep mat of green. On the east flank in a few places larger patches of corn and other subsistence crops extend up the steep slopes. The lower elevations of the range harbor the backward indifferent negro or mulatto and the higher reaches the Indian or mestizo. Strikingly small is the percentage of European blood in the veins of the people anywhere in the region. Thus both environment and population contribute to the lack of development in the Western Cordillera.

The Cauca Valley.—The famed Cauca Valley spreads out in a beautiful panorama between the bold ranges of the Western and Cen-

tral Cordillera. As designated, the region, for 150 miles, has an average width of 15 to 25 miles and an elevation of 2,500 to 3,500 feet above the sea. Near Palmira the valley is nearly 40 miles wide. Some distance north of Cartago the ranges close in, confining the valley to a narrow gorge between huge walls of sandstone and shales. From 40 to 50 miles south of Cali the land rises into the ridge and valley sections north of Popayán. The rolling hills stretching away like storm-tossed waves are the first indication of a southward connection between the Western and Central ranges. Bordered by rolling foothills or high ridges, the floor of the valley is level. Through this plain winds the silvery Cauca, navigable by small craft for almost 190 miles. Along the stream stretch numerous swamps, water spreading over many miles of land during the rainy seasons and shrinking to shallow marshes and ponds in dry weather.

In climate the valley differs markedly from that of the adjacent lands. Temperatures are tropical, daily temperatures ranging from 64° to 92° F or slightly more. There is no well-defined cool or hot season, the daily range being greater than the monthly range. Gentle valley and mountain breezes, a feature of the climate, relieve somewhat the effects of high midday temperatures; the nights are most always comfortable. The valley receives a rainfall of 35 to 50 inches. There are two dry and two wet seasons: January, February, and March, dry; April, May, and June, wet; July, August, and September, dry; and October, November, and December, wet. The precipitation varies considerably from season to season; often irrigation is necessary to protect crops from a prolonged drought or to tide them over a regular dry season.

The soils, primarily of alluvial or lacustrine origin, show the influence of the arid rainfall régime. The soils, consisting of sandy loams to fine clays, of a few inches to 18 or more in depth, are light brown to gray with a yellowish-gray subsoil. In places a high per cent of humus gives a brown to black color. Of fair fertility the soils in low-lying strips near the Cauca are poorly drained; in other areas an impervious layer a few inches thick from 12 to 36 inches below the surface prohibits good drainage. In these areas, in spite of water running away in ditches, the vegetation shows dry conditions or the lack of soil drainage and aëration.

With only a medium amount of precipitation and well-marked wet

and dry seasons, the vegetation shows xerophytic characteristics. Grasslands or savannas cover much of the valley floor. The low flat lands along the Cauca are marsh grasses, bamboo thickets, patches of plumed wild cane, or thick forest belts where a sub-surface supply of water nourishes the forest trees.[3] Elsewhere stony gravelly areas support only a thicket of thorn bushes and tall cacti, suitable only for firewood, as are most of the forest strips also. Native grasses cover much land, but they are being replaced by *Pará, La India* and *Guinea* grasses as the grazing industry advances.

The Cauca Valley is a grazing and farming land (Fig. 262). Much of the region is parcelled out in vast *estancias* used chiefly for graz-

FIG. 262. THE CAUCA VALLEY, SOUTH OF CARTAGO

Much of the level surface of the Cauca Valley is covered with planted *Pará, La India* and *Guinea* grasses; in this semi-arid valley, strips and clumps of trees line the streams and border the swamps.

ing. Three conditions favor a grazing industry: planted pastures of *Pará, La India* and *Guinea* grasses, succulent and nourishing when young, but dry and hard in the dry season and when old; a variety of native grasses of fair quality; year-round ranging in the open; and the small amount of labor required after the pastures are established. *Pará* pastures in good condition, worth $25 to $30 per acre, support one and one-half steers per acre. On the other hand, handicaps to the industry include: (1) inferior stock of the long-horn bony type; better breeds imported have not given good results. (2) Insect pests and diseases; much of the valley is a paradise for the entomologist but a "Hades" for the animals that have to fight the thick swarms of in-

[3] Probably forests once covered a much larger part of the land in the Cauca Valley than at present. Considerable areas have been cleared and planted to forage grasses.

sects. Hoof-and-mouth disease is endemic and the tick is present in all areas, no owners dipping the cattle to prevent its ravages. (3) The protracted droughts, characteristic of the valley, which cause great losses in weight and sometimes in life. (4) Little care bestowed upon the animals; all animals graze together, cows dropping their calves in the open; large herds are under the care of one man; salt put out only once a month, and poor supply of water during the dry seasons. When animals become sick and die they are "pests" left where they drop to spread diseases, meanwhile being devoured by dogs and buzzards. (5) The lack of a market for the animal products of the valley, except hides and skins, pack steers, and mules. The markets consist of the valley and adjacent hills, but they have cattle and mules also. The inferior products (the valley doesn't have a single packing plant of any consequence) cannot move to foreign markets.[4] (6) Absentee landlord, with the care of the *estancia* in the hands of a majordomo, often illiterate and inefficient. Under these handicaps little advance in the grazing industry of an otherwise favored region can be expected for some time. But many of the handicaps can be removed.

Tilled crops, including a variety, occupy only a fraction of the valley land. Cane, cotton, corn, cassava, bananas, and beans are the chief crops. Except for cane all supply only local demands. In the case of sugar only one modern *Central* produces a sugar of fair quality. Many small plants turn out *panela* for local use. On the one modern sugar hacienda—La Manuelita—fair yields of cane are obtained. Some of the cane fields at La Manuelita have grown cane for 90 years without fertilization. Fertile soils, level land, high temperatures, and much sunshine favor cane culture, but the rainfall is somewhat low, irrigation being necessary for the best results; and the division of the year into two wet and two dry short periods retards the best development of the cane; 10 to 18 months are required for the cane to mature properly. On the other hand, several ratoon crops can be cut from one planting.

On several large estates cotton culture becomes increasingly im-

[4] Dairying is little developed. Cows yield an average of two quarts of milk a day, and do not give down their milk unless the calf is tied to them. Calves, separated from the cows in the afternoon, are kept in lots with nothing to eat. A native white cheese sells at an average price of 15¢ a pound, ranging as low as 10¢ and as high as 30¢. Butter in most towns is a luxury, being worth as much as 60¢ to 70¢ a pound for a whitish rancid substance. In the dry season milking corrals without shade are covered with 6 inches of dust and in the rainy season with 12 inches of mud.

portant. Fertile soils, level land, a fair amount of rainfall, and a dry season for picking provide suitable conditions. Most of the cotton produced consists of the perennial types. *Tangüis*, rough and smooth Peruvian, Egyptian and Sea Island, have been introduced and with them the pink boll-worm. The seed is greatly mixed; different length and quality fibers come together. Yields are low; sorting and baling in a careless way result in a product unsuitable for foreign markets. Locally, the cotton brings low prices.

Everywhere in the valley crude agricultural methods give poor results. A bare subsistence is all many people desire. As with the cattle lands, the crop lands, held in large units, are looked after "in true Colombian fashion" by an inefficient manager, the absent owner giving little or no attention to the estate. For most of the products of the soil an outside market does not exist. In the case of sugar, the lower slopes of the Cordillera produce in small crude mills the *panela* for man and beast they require. But in time, favored by auspicious physical conditions, protective tariffs and increasing demands for the products the Cauca can produce—meats, sugar and cotton—agriculture should witness a material advance.

Compared to other sections of Highland Colombia, the Cauca Valley lacks a type of population that will push forward and upward. Though fairly dense, the population doesn't approach in progressiveness that of Antioquia,[5] Cundinamarca, or Boyacá. Fully three-fourths of the population of the Cauca Valley consists of the easily satisfied negro and mulatto; the mestizo group making up most of the remainder can change things little under the control of the small white class, the landowners, the class of wealth and leisure, who prefer life in the city to that on an estate. The percentage of illiteracy averages 75; the people suffer from intestinal diseases, anemia, and malaria, little being done to improve unsanitary conditions for the masses. The valley has a string of towns from Cartago in the north to Popayán in the south; most of them, except Cali, lie near the foothills on the east side of the valley. None of the towns have developed manufacturing industries of note: small plants, employing in all of the towns only a few hundred people, make fiber bags and mats, cigarettes, soap, candles, bricks, sandals, and clothing. The towns are con-

[5] These three provinces, the first in the northern part of the Central Cordillera, and the other two in the central part of the Eastern Cordillera, on the whole have the most progressive peoples of the republic.

nected by the railway which extends the length of the region and connects at Cali with the line to Buenaventura. The railways, the navigable Cauca for small craft and good roads during the dry season should foster development. With these and favorable physical conditions why has the Cauca failed to become the "promised land" that Colombians have expected it to become? Why have the thrifty people of Antioquia failed to spread out into this smiling valley? It may be the permanent large estates that have deterred them. On the other hand, it seems that the production of a crop in demand in the northern hemisphere has kept these people on the coffee *fincas* of the steep, rainy, fertile slopes of the Central Cordillera, leaving the Cauca to an extensive type of agriculture.

The Central Cordillera.—The Central Cordillera, from the Pasto knot, extends northward in a belt 30 to 50 miles wide for 500 miles. An unbroken rampart of colossal mountains, it is crowned with a series of towering volcanic peaks—in all one of the boldest topographic features of the entire continent. Near the southern end Puracé rears its truncated cone to 16,000 feet; northward in order, Huila (18,000), Tolima (18,400), Santa Isabel (16,760), Ruiz (17,400), Nevada de Herveo (18,350), pierce the heavens with snow-crowned summits. Farther north after a series of peaks 19,000 feet high, the great mountain mass diverges into a number of ranges in the Antioquia region and drops off rapidly in a broad stream-eroded front to the low-lying plains of the Cauca and Magdalena. With no low passes it exacts a heavy toll of all who choose to traverse its gaunt bulks; only three major routes cross it: the mule trail through the Guanacas pass (11,000 feet) connecting the upper Cauca and Magdalena Valleys; the automobile road and mule path from Armenia to Ibagué via the Quindío Pass (11,440) and the railway from Medellín to Puerto Berrio.

Rising throughout its extent from the low foothills and ranges along the Cauca and Magdalena to great heights, the Central Cordillera possesses the range of temperatures, precipitation, vegetation, and crops as indicated in the preceding portion of the chapter. Of course, the zones everywhere are not uniform. The subtropical forest belt lies from 1,000 to 2,000 feet lower on the western flank than on the eastern. From north to south there exists a difference also. The lower limit of the forest belt in response to greater precipitation and

some difference in temperature decreases from 5,000–7,000 feet in the south to the waters of the Cauca in 7° N. latitude. Crops and human activities show a similar response. The major zones include the fertile slopes and steep valleys, areas of coffee, sugar cane, bananas, corn, fruits and cattle; the higher subtropical and temperate dense forests, green pastures, temperate cereals and root crops; and the high *páramos*, covering considerable area. A region of low-hanging fogs, flashing lightning among the clouds and over the pinnacled peaks, and cold piercing gales, the *páramos* attract few people and these only in the milder months. The dense forest zones also have few people.

By reason of agricultural resources, minerals, facilities for manufacturing, and population elements, the Central Cordillera possesses some of the more densely settled and more advanced areas of Colombia. Standing out in contrast to those of either the Cauca Valley or the Western Cordillera, the population consists of a high class mestizo and white in the northern section and western slopes and of almost pure highland Indian in the south. They are a hard-working lot, except an upper leisure wealthy class, and desire to improve their condition of life. The denser areas of settlement include the deep valleys and slopes of the northern end of the region in Antioquia and the western flanks from north of Manizales to 3° N. latitude and the high valleys and basins in the region south of Popayán. Medellín and Manizales are the leading towns; the former with an almost ideal climate is a clean modern city of nearly 100,000 inhabitants, living under healthful surroundings. Antioquia has 35 cities of 10,000 people or more. Illiteracy, characterizing 80 per cent of the people of the nation, is low in this department; 40 per cent of the factory workers in Medellín read and write. Families are large and the progressive population constantly flows into adjacent regions.

The Central Cordillera has a variety of forest, mineral, and other resources, but farming and grazing support most of the people and produce the chief commercial products.

Coffee.—Coffee dominates. Though occupying a small per cent of the total area, it is widely dispersed in the highland valleys from 2,500 to 6,500 feet, the better coffee coming from the middle and upper portion of this zone. The chief areas of production include the

fertile slopes of the deep valleys on the western flank of the range from north of Medellín to north of Popayán.

Auspicious physical conditions and a people willing to labor favor coffee culture. Most of the coffee plantations occupy regions of rugged relief, but the steep slopes, often of 25° to 30° angles, in deep valleys provide the free movement of soil moisture so essential to the coffee tree. Also these deep valleys are sheltered from desiccating winds and strong winds that would break heavily laden trees. Red fertile soils high in potash and iron and several feet deep aid in producing good yields. Temperatures ranging from about 58° to 78° F are most favorable; on lower hot slopes large strong berries grow, trees requiring much shade and considerable attention; higher up trees yielding smaller and milder berries require less shade and only a fair amount of attention, but they have a shorter life. Although varying greatly, the annual rainfall of from 40 to 75 inches in normal years is well distributed for the proper flowering and fruiting of the plant and for harvesting and drying the berries. During the rainy season mists and clouds drift up the valleys in the hottest part of the day and drench the coffee trees with a convectional shower and shelter them from the hot rays of the noonday sun. A combination of these physical conditions and good methods of preparation give to the coffee of this area its distinct quality; as mild coffees, valuable for blending, they contain a large proportion of essential oil, low weight of ash, high caffein content, great density, and uniform green color of berries.

Plantations in size and number of trees vary greatly in different districts, but in this region the small producer dominates, especially in the north.[6] Here small plantations are owned by individual farmers who, with large families, take care of all the work of the plantation (Fig. 263). This section produces the best quality coffee and the greatest yield per tree.

On the whole, methods of culture are excellent; methods of tillage and preparation compare with those in the best coffee regions of the world. Trees are planted systematically at distances of about 5 feet on fertile soil, or 8 to 10 feet on less fertile soil; shade trees of *pisquín* (*Erythrina edulus*) and *guamo* (*Inga vera, I. sapida*) are

[6] In Colombia the average plantation has about 9,000 trees; only about 225 contain more than 100,000 trees; the great majority have less than 5,000.

placed at 35 to 50 feet, distance varying with altitude. The land is tilled once or twice a year. In spite of a labor shortage only ripe berries are picked; two pickings a year in most sections yield from one-half pound of cleaned coffee per tree per year to 1¾ pounds in the better districts of Antioquia. At the same time a far better quality berry is the result.

The industry labors under other handicaps. Owing to attractive work and wages in construction units and to the ease of life in some sections, there is always a shortage of labor which often becomes

FIG. 263. A SMALL COFFEE "FINCA" SOUTH OF MEDELLÍN

In the subtropical valleys from 3,000 to 6,000 feet the small coffee farmers of the Central Cordillera produce, by careful methods of tillage and preparation, a high-grade coffee used in blending with stronger coffee from other regions.

acute at harvest time. Recent estimates place the portion of the crop lost, for want of laborers to gather it, at 15 per cent of the total. Just before the harvest, urgent calls for laborers are posted in frequented places in all Andean recesses. Few immigrants come to these parts. When gathered and prepared for shipment the coffee meets high freight rates to the coast, and months may elapse before the crop reaches ocean shipping.

Sugar.—Sugar constitutes an important crop in all sections of the region up to 6,000 feet. It is grown on all large coffee estates and occupies considerable areas on many haciendas producing only cane and subsistence crops. On the heavy red clay soils and with a good rainfall cane grows year after year without replanting. All mills are

small and manufacture *panela*, a valuable food for man and beast.[7] Much of the cane goes for the manufacture of *aguardiente*, the chief beverage for the laboring classes.

Low Altitude Subsistence Crops.—Almost every coffee and sugar estate has a large quota of subsistence crops, including corn, beans, cassava, and bananas. Up to 6,000 feet bananas find a significant place on large and small farms alike. A few plants near a laborer's hut provide an abundance of starch foods from year to year without any labor; on the coffee estates bananas not only supply the chief

Fig. 264. The Central Cordillera near Medellín

food, but in many sections serve as shade for the tender young coffee plants and at the same time keep down the weeds between the coffee bushes. Near large towns more extensive banana fields indicate a commercial production for the urban districts; also, frequently on the trails trains of mules wend their way to highland towns with loads of bananas. Though bananas grow up to 6,500 feet in sheltered places, the size of the plant and the fruit decrease with elevation, those grown at the upper limit being of little value.

Temperate Crops.—Temperate crops, corn, wheat, barley and root

[7] One crossing the Andes on mule back stops frequently during the day and purchases a cake of *panela* for the mule; it can be had at nearly every roadside *posada* no matter how high and remote.

crops are produced on the higher elevations, but they are not as important in the Central Cordillera as in the Eastern Cordillera, because a smaller part of the temperate belt of the former is occupied than that of the latter except in the far south.[8]

Grazing.—In the northern two-thirds of the Central Cordillera the animal industry is especially well developed (Fig. 264). In Antioquia, Caldas, and Tolima—the three northern departments—many intermediate slopes have been cleared of their forests and planted to *Yaragua* grass. The slopes not in coffee or other crops, from 2,800 to 5,000 feet, are covered with this rapidly growing grass, that covers the

Fig. 265. Black Ear Cattle, Medellín

In these cattle the highlands of Antioquia have an excellent beef and meat animal; plowing on the experiment farm with one of the few modern plows in all Highland Colombia.

ground, is tick-free, owing to small globules of oil on the stems, and is an excellent forage for fattening. Higher up gramma and many other short grasses carpet the slopes with a velvet of green up to the *páramo*. Cattle, mules, sheep, and swine are reared; this region has the best-developed beef and dairy region of Colombia, having produced an excellent native beef and dairy animal in the *oreja negra*—black-eared cattle (Fig. 265). Many families in the coffee region and above subsist completely from the products of the pasture and those that they market in the near-by towns—hides, mules, steers, or cheese—or to travellers on the trail.[9] Most everywhere the omnivorous

[8] See pages 600–603 for a discussion of the temperate crops.

[9] My guide on a trip from Medellín to Manizales stopped frequently at a *posada* and purchased a glass of milk. If the keeper had none, a woman would run out to a tethered cow and bring back a cup fresh from the udder.

"porker," tall, thin, bony and "long-snouted," roots for a living, though many small coffee farmers have no use for this troublesome animal. In the southern portion of Central Cordillera sheep and llamas dominate. This is the only portion of the Northern Andes where the llama is the burden bearer that he is farther south.

Mining.—The northern portion of the Central Cordillera has been one of the great mining regions of South America. The isolated mountain ridges and valleys contain a variety of minerals, but difficulties of exploitation, except in the case of a few, have retarded development. Most of the important mineral sections can be reached only by pack trains over almost impassable trails, so that transportation costs are prohibitive for heavy and expensive machinery, the lack of which hinders development along modern lines.

From the time of the discovery of gold in Colombia to the present day, mining has been devoted almost exclusively to the production of the precious metals and preeminently to that of gold. The total gold output of Colombia exceeds that of Brazil, its nearest South American rival and the country which staged the first gold rush of modern times. The annual output amounts to about $5,000,000. Both lode and placer gold are produced, though fully two-thirds of the total output comes from placers. These placers are widely distributed, but two regions—the department of Antioquia and the *intendencia* of Chocó—have been and are now the great placer-gold regions of the country. Nearly all the tributaries of the Magdalena and of the Cauca heading in the Central Cordillera carry placer gold; the Nechí and the Porce have been most productive of all, and to these Antioquia owes its rank in Colombian gold mining. The chief district where the gold occurs in lodes lies in the Central Cordillera, in the departments of Antioquia and Caldas; a second region exists in the southwestern part of the country, and a third in the departments of Santander and Bolívar in the northern part. Hundreds of lode mines are in operation, but only on a small scale, and few are worked by modern methods. Plants and machines are small, and difficulties of bringing in modern mills, as well as uncertain and complicated mining laws, have restricted operations. Lode mines now yield about a third of the gold, but with the development of the quantities of available water power, improved transportation, and new equipment these mines will considerably increase their output.

A few thousand tons of fair quality coal are mined along the new railway from Medellín to the Cauca Valley and supply local industries. Other beds outcrop in the Central Range. Iron ores exist in several places; three iron works near Medellín operate successfully though only on a small scale. But large-scale mining awaits the development of transportation, improvement in technique, the rise of

Fig. 266. A Cotton Factory at Manizales

The cotton textile industry is one of the leading manufacturing industries of Colombia; Medellín and Manizales are two of the leading centers for the manufacture of cotton textiles in the republic. (*Courtesy of Ewing Galloway.*)

a skilled labor class, and the bringing in of capital to undertake new enterprises.

Manufacturing.—The resources in minerals, raw materials, power, capital, labor and a market have made of the Central Cordillera, especially the northern portion—Medellín and Manizales—the chief manufacturing region of Colombia (Fig. 266). Medellín leads by far; the city and adjacent area have forty good-sized manufacturing establishments. It has cotton and woolen mills, four iron works, shoe factories, ice plants, soap, candy, bottle factories, and breweries. The surrounding districts have many sugar mills, while throughout the region many people are engaged in home industries. Several mountain towns from Medellín to Pasto are important centers for Panama

hats, sandals, and clothing made by hand. But as the market for most manufactured wares is restricted, this activity occupies the attention of only a small part of the population.

The Upper Magdalena Valley.—The Upper Magdalena Valley from 1,000 to 2,000 feet above the sea in many respects resembles the Cauca Valley. It has many level alluvial stretches, but mountain spurs come to the river banks in many places. Stony sandy areas alternate with heavier and more fertile areas of clay loam, brown to gray, soils. It is hotter than the Cauca, midday temperatures frequently reaching 95° F in the shade and those at night seldom dropping as low as 65° F. It receives more rain than the Cauca—Girardot gets 75 inches—with two seasons of rain and two of drought, though not as well marked as in the Cauca.

From between La Dorada and Honda to near the head of the valley the area presents a semi-arid aspect, in striking contrast to the luxuriant forest farther north. A good forest growth caps the ridges, but the lower slopes below 2,000 feet or thereabouts and many narrow valley floors leading into the bordering ranges support only bushy growths or sparse grasses. In many places are strips of lighter mimosa forest and xerophytic types. Agavas, cacti, and other similar forms present almost impenetrable thickets, but elsewhere they appear alone, giving a desert-like appearance.

As in the Cauca, grazing is the dominant industry, many large *estancias* extending across the valley and into the foothills. On the better *estancias* much *Pará* or *Guinea* grass has been planted. Cattle, goats, horses, and sheep are the chief animals grazed. The stock is of low quality and receives little attention by the mulatto and mestizo population suffering from hookworm, anemia and malaria. A market for much of a surplus does not exist.

But at many places in the valley are fertile farm areas of brown clay loam soils that produce a variety of subsistence products—sugar cane, corn, cassava, beans and bananas. In places tobacco is a commercial crop of note as are the others to a limited extent. The town of Ambalema has a reputation for its fine tobacco and cigars.[10] Both farming and grazing are handicapped by poor methods, insect pests and diseases, inefficient labor and the lack of markets.

The Upper Magdalena, like the lower portion, assumes great im-

[10] The town has three large tobacco and cigar factories.

portance in transportation, the river being navigable by flat-bottomed river boats in stretches up to Neiva. All of its chief towns are interested in the receipt and transfer of freight and passengers. La Dorada, the head of navigation on the lower river, ships by rail to Honda, where river navigation is resumed. Honda is also the terminus of an old Spanish road to Bogotá—now a highway leads to the capital along this route. Mariquita is the terminus of the aerial cableway from Manizales; Ibagué in the foothills of the Central Cordillera and at the end of the railway of the valley is connected to Armenia by an automobile road. Neiva stands at the head of navigation on the upper river, and Girardot at the rail point connecting river and hydroplane services with Bogotá.

The Eastern Cordillera.—From the Pasto knot the Eastern Cordillera extends to the northeast for 700 miles, embracing more than one-third of Highland Colombia. In the south portion the range averages 25 to 40 miles in width, is largely forested, lacks the great heights of other sections, and is sparsely settled. North of 4° N. latitude the mountain mass broadens to nearly 120 miles in width; it rises in three groups of parallel ranges crowned by several great domes from 13,000 to 16,700 feet, the culminating points of the Eastern Cordillera; between the groups of ranges lie many flat-floored savannas—old lacustrine basins—and deep valleys. The Eastern Cordillera has fewer volcanic summits than the Central Cordillera, much of the mountain mass consisting of sedimentary rocks with many igneous intrusions throughout the range.

The Eastern Cordillera possesses the temperature, precipitation, vegetation and crop belts similar to the Central Range, but the great width of the mass north of 4° N. latitude gives to this region a much larger area of temperate climate than either the Central or Western mountains. In the temperate region the savannas are prominent features. The chief savannas include: the *Sabana de Bogotá,* 30 miles wide and 75 miles long; the Ubaté-Chiquinquirá, an irregular belt 20 miles wide and 50 miles long; and the Duitama-Sogamoso savanna; all lie between 8,200 and 8,600 feet. Besides these, smaller ones are scattered through the high portions to almost the Venezuelan border. These level areas possess fine loam to heavy clay soils, but of low fertility (Fig. 267). Surrounded by high mountains, they receive only a fair quota of precipitation. Bogotá gets about 40 inches per year;

there are two rainy seasons and two of less rain; July and August, the driest months, have less than 2 inches. The precipitation varies greatly from season to season, long periods of drought being a great handicap. Temperatures range between 40 and 74; the sunny days are comfortable but the rainy days and nights are disagreeable.

The wide portion of the region has the second area of major concentration of population of the republic. The chief areas include the deep fertile valleys and slopes and the high savannas. In general the high-grade mestizo, the hard-working Indian and the considerable numbers of whites contribute to a much better type of people than possessed

FIG. 267. HARVESTING WHEAT IN THE SABANA DE BOGOTÁ

In the broad level savannas of the Eastern Cordillera wheat is a chief crop; on only a few of the large *haciendas* are modern implements used.

by the lowlands. The people suffer less from diseases, are more energetic and aggressive, though not to the same extent as the people of Medellín, and more literate than lowland peoples; nearly half the people of some sections are literate. To these favorable qualities and to its resources this portion of Colombia owes its economic significance.

In spite of a variety of resources farming and grazing occupy the attention of most of the people. Subsistence crops and animal products contribute most to the direct support of the population, but coffee overshadows all others from a commercial point of view.

Coffee.—Two zones of culture produce much of the coffee which compares favorably in quality with the coffee from the Central Range. They include the steep slopes of heavy clay soils from 2,500 to near 7,000 feet elevation on the Western flank of the range from Ocaña to

south of Neiva—much of the output of this strip comes from north of Girardot—and the deep valleys in the circle of mountains south and west of Cúcuta. Some comes from small areas on the eastern flank of the mountains where precipitation conditions are favorable. In the region as a whole the coffee estates are much larger than those in the Central Range, but excellent methods of culture in most sections give a good quality product. Many of the plantations of Cundinamarca and Boyacá receive as good care as any in Colombia. However, in the northern part of the region methods and yields are poor. Here trees seldom pruned grow from 10 to 14 feet high, have a large number of non-bearing branches and yield only about one-half a pound of coffee per tree. As elsewhere, a shortage of labor handicaps the industry.

Other Crops at Intermediate Altitudes.—The coffee regions produce a variety of crops, often on a large scale. In addition to purely subsistence corn, cassava, and nuts, they include sugar, cotton and tobacco.

Sugar grows in every section on steep slopes and narrow valley floors, often irrigated; Cundinamarca, Boyacá and the Cúcuta region are important sugar areas. With fertile clay soils and a fair distribution of water cane grows year after year on the same land without replanting. Records show that cane fields have not been replanted in the last 20 years, in the Cúcuta region, a ratoon crop being cut every 12 to 14 months; some fields have grown cane for 100 years without rotation or fertilization. The cane gets only one or two cultivations with a hoe per season. Consequently the yields of cane and sugar content are low; yields of 5 to 10 tons of cane are considered good in many sections. "*Gomosis*" and "*Mosaic*" infest most areas. Most estates manufacture in a crude small mill the *panela*, the brown cake sugar so valuable for man and beast; but much of the sugar goes for the manufacture of *chicha* or *aguardiente*.

Of long standing, tobacco culture, though carried on in many sections, occupies much less land than the major commercial crops or the chief subsistence products. Tobacco is cultivated in numerous small valleys on sandy clay loam and sandy loam soils in rather small areas at intermediate elevations. In contrast to sugar cane, little is irrigated, the farmers depending upon precipitation for a moisture supply. Tobacco receives more care in cultivation than many other

crops. The tender plants, transplanted from nursery beds to well-prepared soil, are cultivated with hoe two or three times a season. But being grown by small farmers almost entirely, vast room exists for improvement in seed selection, care of the plants at gathering time, drying, curing and grading.

Temperate Crops.—Corn, little used as a feed, constitutes a staple food for the lower and middle classes from sea level to 8,000 feet or a little higher; in addition, it serves for the manufacture of quantities of *chicha*. It grows as the first crop on cleared or burned-over lands in the establishment of a coffee plantation; it does well on steep slopes and on poor soils, producing big ears of fair quality. Only in a few of the better farmed areas is corn carefully tilled; planted in rows varying in width, it may be cultivated in some areas once with a one-ox wooden plow or with a hoe; in other areas only the weeds are cut out with a machete. Usually pole-beans planted with the corn use the stalk as a support. Though occupying more land than any other crop, several conditions restrict a wide movement of corn; corn has a high percentage of moisture and does not keep well; it cannot be stored more than a few months because of the weevil; transportation costs are prohibitive for such a bulky commodity; many valleys may have a large surplus of corn at harvest time, unable to dispose of it even though corn brings $3.00 per bushel in a highland station 50 or 100 miles away. Only in the form of *chicha* can it traverse distances and yield a profit.

Of long standing, wheat culture engages the attention of many highland farmers. It grows in large areas on the high savannas and climbs high up the steep mountain slopes (Fig. 268). In these places the fields of golden grain occupy much of the farm land up to 10,000 feet elevation. Many varieties of native wheat, most of which are rust resistant, produce a kernel of good quality; everywhere yields average low, from 5 to 7 bushels; in exceptional places and under unusual conditions 10 or 12 may be obtained. Despite widespread culture, the yields do not supply the demand, imported wheat and flour being consumed in quantities. Local wheat may command a price of $5.00 per bushel, and still yields remain low. Methods of tillage are crude as with all crops except coffee; a crooked stick for a plow, a hoe and a machete are the universal tillage implements. A number of conditions preclude the use of modern machinery: remote-

ness from ocean ports; the difficulties of distribution within the region; an illiterate farming class; rough surface of most of the farm lands, absolutely precluding the use of machines; and the unwillingness of landowners to go to considerable expense introducing improved machines which would increase the idle hours of the estate laborers and result in the surplus of a product that could not be marketed owing to transport difficulties. Except for coffee culture in

Fig. 268. Temperate Crops, 7,500 Feet at Cacota

Throughout the Eastern Cordillera at elevations above 7,000 feet temperate cereals and grasses cover many of the hillsides; on the steep slopes modern machinery can not be utilized in growing these crops.

some areas, the agriculture suffers from other handicaps: lack of any seed selection, absence of crop rotation, no fertilization, ravages of insect pests and diseases, prevalent poor methods of tillage and preparation of products. From estate records in the *Sabana de Bogotá* wheat has been planted on the same piece of land for 40 consecutive seasons without the employment of any fertilizer. Wheat sown broadcast and cut by hand with a sickle is tramped from the sheaves by oxen or mules on earthen floors enclosed by a stone wall and winnowed by the breezes.

At higher elevations and on infertile soils barley replaces wheat in

many places and in southern Colombia *quinoa* retains the position among the crops which it holds in the Andes farther south. As with wheat, the quality of the grain is good but yields are low, due not so much to adverse physical conditions but to poor methods of culture.

Throughout the high sections up to near 12,000 feet the Irish potato comes into its own, supplying much of the food for the poor farmer, while *aracacha* (*Arracacia moschata*), a small tuber, and several vegetables add variety to the diet. They are tilled in small patches

FIG. 269. TRANSPORTING MILK TO BOGOTÁ

While a number of the *estancia* owners of the *Sabana de Bogotá* have improved their stock by the importation of pure-bred animals, most of the cattle consists of tall, rough stock, excellent for draft purposes but of little use in producing dairy products or high-quality meats.

on steep slopes adjacent to the houses or where a tiny patch of soil promises a fair yield.

Animals.—Throughout the region, cattle, mules, poultry, and swine find a place in the agricultural economy, and sheep in the higher parts. Even the large coffee estate has its area of *Pará* or *Guinea* grass in the moist hot valleys or its area of short grasses on the high slopes. *Yaragua* grass, which has given such excellent results in the Central Cordillera, is just beginning to be used in this region, 50,000 acres having been planted in Cundinamarca. But the temperate areas have the best-developed grazing industry. In the savannas, gramma and other temperate short grasses, and in a few places alfalfa, supply excellent forage as do the *páramos* for a short summer season. But the cattle breeder of the Eastern Cordillera feels the competition of the hordes of cattle that pour into the region from the great llanos

to the east. In the savannas much has been done to improve the stock by importation of pure-bred cattle, fenced ranges, regulated breeding and better care of animals. Yet in most areas the stock is of low grade and methods are far from modern. The warble does considerable damage; other diseases are endemic. Nowhere is milk treated and delivered as certified (Fig. 269); it being delivered in the cities by cup dipped from a can on the back of a burro or from a spigot of a can; the milk pails even on good farms, washed in the irrigation ditch or near-by streams, are seldom scalded.

Manufacturing.—The Eastern Cordillera has many centers of manufacture and a variety of industries that make it one of the leading manufacturing areas of northern South America, but the commodities turned out supply only a fraction of the demands of the population. For manufacturing the region has a number of favorable conditions. Although it produces most of the emeralds of the world, some gold in Bucaramanga, and medium grade bituminous coal in several sections, it has developed none of the basic minerals for a large industrial development. An abundance of water power in the region remains unharnessed. In spite of its forests, even the capital of the country is supplied with lumber cut by hand and brought to the savanna on the backs of mules. For mass production a profitable market hardly exists as most of the people have a low buying power. The leading industries include sugar mills, tobacco factories, breweries, brick factories, soap, matches, glass works, flour mills, and chocolate factories. Bogotá and Bucaramanga are the leading centers. The former, the capital of the republic, is a modern city in many respects—electric lights, telephones, street cars, paved streets, water supply, a big distributing business, and clubs, theaters, and universities.

THE DOMINANCE OF HIGHLAND COLOMBIA

Occupying less than one-fourth of Colombia, the Highland region has most of the people, the chief transportation facilities, produces nearly all of the exports, purchases the majority of the imports and makes most of the manufactured wares of the nation. With increasing transport facilities, a variety of resources, and nearly all the people of progressive tendencies, Highland Colombia will continue to dominate the nation and will advance far in the years to come.

CHAPTER XLI

THE EASTERN PLAINS OF COLOMBIA

Considerably more than half of Colombia's territory lies in the great plains to the east of the Andes. So far as the general life of the country is concerned, however, this vast area plays a minor rôle. Nevertheless it has greater utility to Colombia than the *Oriente* to Ecuador, the population along the rivers and near the mountains being much greater than that to the south. Moreover, it has prospects of a far more rapid development, chiefly by reason of its large area of savanna at the north and the access of these lands to good-sized navigable streams leading to the Orinoco and the sea.

Like many similarly situated regions, the Eastern Plains of Colombia owed their first peopling by white men to missionaries. These men descended from the plateau about Bogotá and attempted to spread enlightenment among the Indians. Their difficult task affected only a few of the natives, large areas still holding totally independent Indian tribes. Owing to the comparative openness of the land, the savannas of the north, between the Meta and Guaviare Rivers, lent themselves more readily to colonization, and there today lie the chief settlements of the region. This early colonization was devoted to pastoral pursuits; the raising of livestock continues to be the leading occupation for the region as a whole, although to the south the dense tropical rain forest precludes grazing and instead yields rubber and *balata*.

A density of population of three-tenths persons per square mile indicates the backwardness of the region. If from this are subtracted the settlements in the cattle country about the Casanare and Meta Rivers, the figure sinks further and embraces only a few gatherers of rubber or *balata* and various small groups of forest Indians. These latter live just as do the corresponding inhabitants of other parts of greater Amazonia, a life not burdened by one of toil but one on a low scale of civilization. Along the northern rivers, including Orinoco, Guaviare, Meta and Casanare, the case is different. Here mestizo

and Indian enter commercial life; far into the land the stream-courses show strings of settlements, generally of only a few thatched huts surrounded by garden patches of corn, cassava, and bananas. The cattle-herds constitute the major source of revenue and their care is intrusted to the *llanero*, a roving horseman, as typical of the llanos of Colombia or Venezuela as formerly the *gaucho* of the Argentine Pampa or the American cowboy of the western plains of the United States.

Though the several rivers lessen somewhat the shortcomings of location, the region suffers from remoteness. Only in the northwest, where the savannas lie relatively near the populous plateau of Cundinamarca and Bogotá, does traffic between mountain and plain become important and there it is limited chiefly to cattle hides and live cattle from the llanos and in return a few manufactures and foodstuffs. The trails perhaps are less precarious than in Ecuador, but they are typically east Andean—steep, rocky and slippery trails in densely forested territory.

In its major aspects the region embraces three types of land. South of the Guaviare River it consists essentially of true Amazonian tropical rain forest extending in unbroken stands between the rivers—a uniformly warm wet land of little relief. Northward succeeds a transition zone between Amazonia and the llanos which finally grades into the extensive savannas—like those of Venezuela, but of better quality for grazing. The major relief features occur in the sections neighboring the Andes and in a slightly elevated central portion serving as the divide between drainage to the Orinoco and the Rio Negro.

On the extensive savannas graze some 300,000 head of cattle. They consist of low-grade stock grazing on the broad plains, some fenced, but mostly unfenced (Fig. 270). They receive little or no care. At present little opportunity exists for widespread advance. Remoteness is one great drawback. Though forage is of relatively good quality and the rivers permit considerable commerce, the only possible markets lie in the highlands and are accessible only at great expense. In general the cattle are selected for the trip into the highlands at the age of from five to seven. Though they leave the plains in good flesh they arrive in the market centers of Bogotá, Tunja and other towns in poor flesh, little more than skin and bones. One can almost hang one's hat on them at any of the many protruding points. Often the feet of

the animal become so sore that one by one they drop out on the trail and are disposed of for what the local butcher will offer. In crossing the *páramo* the animals suffer greatly as does the half-clad *llanero*, cattle driver. In this condition they cannot supply even a medium quality meat. Cattle hides largely constitute the export of the 200 *haciendas* producing livestock in the Colombian llanos. The major

FIG. 270. PLANTED GUINEA GRASS PASTURE NEAR PAMPLONA

Tall rough cattle brought over the Andes from the llanos fattened on pastures in the deep valleys before being sent into the highland markets; even when fattened these mixed cattle dress into only a poor quality meat.

route to the upland goes via the Casanare River to the market town of Tunja, a distributing center for highland districts.

A number of conditions retard the development of the cattle industry; remoteness, the small size of the highland market, low-grade animals, poor methods of breeding and grazing, the ravages of ticks, pests and diseases, the uncertain precipitation at times and the consequent shortage of forage, the absentee landowner and the shiftless *llanero*. Much might be done by crossing shorthorn cattle with the stock of the plains, but the cost of importing good stock, the dangers of losing them on the road or in the region soon after they arrive and the lack of cooperation by the government are prohibitive. Also before animals could be cared for, the careless and shiftless ways of the

llanero would have to be overcome. That seems well-nigh impossible. At best it will be a long slow evolution.

Whereas the north is oriented in large measure toward the mountains, although the east falls somewhat into the sphere of the Orinoco River and thereby Ciudad Bolívar, the zone of forest products to the south has a leading outlet to the Amazon by way of the Putumayo River. Along this route descend the balls of rubber and sheets of *balata* to be assembled at Manáos for transshipment. A small quantity in the higher lands tends to gravitate toward the Pacific Coast, but the expenses of mountain transportation limit the possibilities of this movement.

Their variety in principal types of vegetation has given parts of the Eastern Plains of Colombia a certain degree of development, but in all aspects appears the one great hindrance—isolation. It is true that the several rivers have permitted greater exploitation than in eastern Ecuador, but these streams have far less value than those of Peru or Bolivia to the corresponding regions in those countries. No railroad is likely to bridge the zone of mountain slopes to afford greater ease of communication between highland and plain; and eastward lie the vast Venezuelan llanos with a much greater livestock development. The region will remain as it is for many decades.

CHAPTER XLII

VENEZUELA

In recent years, Venezuela has undergone more changes than any other country in South America. Moreover, so profound are those accomplished as well as pending changes that Venezuela claims an exceptional amount of newspaper space. In general, the alterations fall into two groups: economic and political. Under the economic developments there exists one chief concern—Maracaibo petroleum; but Venezuelan coffee and cacao are by no means decadent industries. As for the political matters, the great concern is essentially Venezuela's geographic character as reflected in one of the most variable political situations in the world.

The growing threat of political eruption in the country carries with it realization of Venezuela's division into four major natural regions: one of which matters very little—the Guiana Highlands; a second has moderate significance in Venezuelan life—the llanos; and a third and a fourth region—Andean Highlands and Maracaibo Basin respectively—where lie most of what Venezuela means today. These four zones, particularly the last two, differ so much among themselves as regards natural resources and therefore economic interests that such internal dissensions are inevitable. As yet, because of the tremendous difficulties involved in providing good transportation between mountain and plain, the exchange of products which arises in consequence of the contrast in conditions does not draw the regions together as much as it will at some later time.

In general, the Maracaibo Basin consists of a hot and unhealthful lowland about Lake Maracaibo. It produces most of Venezuela's sugar, raises considerable cacao, transships the bulk of highland-grown coffee, and because of its great resources in petroleum has become the scene of the greatest activity in Venezuela. Cutting off the basin from the llanos are the Andean Highlands, the most densely populated part of the country. This comparatively temperate region constitutes the physical as well as the economic backbone of Vene-

zuela, supplying the principal export as well as locally consumed crops, and contains the country's chief cities other than Maracaibo. In its long stretch from Colombia and along the Caribbean coast on into Trinidad, the highland area almost completely bars the heated llanos from the sea. These great interior plains, which as a cattle

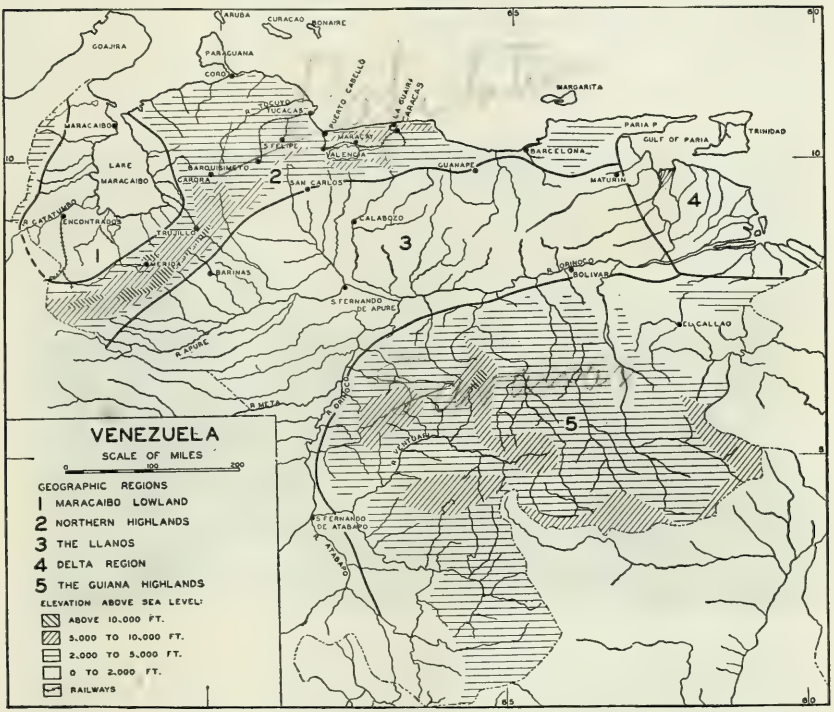

FIG. 271. MAJOR GEOGRAPHIC REGIONS OF VENEZUELA

land have so far failed to come up to optimistic prophecies, extend over some 130,000 square miles from the mouth of the Orinoco to the borders of Colombia. Finally, south of Venezuela's one great river highway, the Orinoco River, lie the vast but little utilized Guiana Highlands, a region of tropical rain forests and savannas (Fig. 271).

In all, these four regions aggregate 394,000 square miles in area and have a population of 3,000,000. Mestizo, Indian, and negro elements form a numerous very low class far removed from a powerful and rather progressive upper group. Owing to its paucity of temperate lands, the country attracts few immigrants despite certain

alluring laws. West Indian negroes are the most common arrivals, although of late the unprecedented developments at Maracaibo have brought in many American and European engineers and business men, whose stay, however, is but temporary. The oil fields have also caused a dangerous surplus of city population, owing to the high wages, so that until a recent reaction the agricultural districts have suffered for want of hands.

In regard to its facilities for transportation, the country shows several notable contrasts. Its coast line, for example, is the most

Fig. 272. The Port of Maracaibo

Maracaibo serves as an entrepôt of trade for the Cúcuta region of Colombia and much of the highland region of western Venezuela in addition to its traffic of the lowland; Maracaibo, the leading port in Venezuela, in many ways is a modern city.

favorably indented of all South America; but in its highlands, there is an average of 7 expensive bridges to 6 more expensive miles of track. Again, the rugged highlands where construction is so difficult have far better communications than the flat lowland plains; but the latter have the great channel of the Orinoco River and in the north the rivers about Lake Maracaibo (Fig. 272). These differences and the lack of inter-regional facilities bring Venezuela into close relations with its two foreign ports, Curaçao and Port of Spain. The former handles the agricultural products and oil of much of the west, the latter serves as a clearing point for the east and much of the llanos.

This dependence upon West Indian points is a matter of long standing and suggests Venezuela's historical significance relative to the islands of the Caribbean.

COLONIAL VENEZUELA

Venezuela's first European inhabitants were a band of pirates who in 1510 established a temporary base on an island near the east coast, from which they raided the Indians in order to sell them to plantation owners in the Antilles. Ten years later on the near-by coast was founded Cumaná, the oldest European settlement in South America. The immediate region achieved some importance because of some rich pearl fisheries about the isle of Margarita, but having soon exhausted the fisheries and finding no gold, the Spaniard turned his attention farther west and founded Coro in 1527. Thence land and water routes took him to his gold as well as to productive agricultural districts in the highlands of the interior (Fig. 273). Ruthless plundering and butchering ensued and the search for gold led the men eastward. In the garden spot of the Lake Valencia Basin, they founded Valencia in 1555, for there lay gold. Working from that point, they managed to gain the fertile as well as easily defensible valley of Caracas, where in 1567 they set up the seat of government. Ten years later, they had made a port at La Guaira and Venezuela entered on a period of comparative prosperity. Favoring expansion in the new lands were: direct communication with the West Indies and Europe; fertile, healthful, highland valleys lying at insignificant heights as compared to those of Colombia, Ecuador, and Peru; a great interior savanna easily reached and traversed.

Nevertheless here they had no really enticing reserves of gold or silver, and as a result the Spanish neglected their colony. Settlements expanded on a small scale and took up agriculture; cattle introduced in 1548 multiplied tremendously on the llanos, but crops and cattle failed to intrigue the Spanish *conquistador*. Venezuela, like others of the colonies, suffered from many commercial restrictions, and smuggling became a lusty branch of commerce. Various reprisals by the mother country tended to rouse the antagonism of an already touchy group of colonists and Venezuela declared its independence in 1811. Declaring independence was not achieving it, and the country entered upon an era of troubles from the effects of which

FIG. 273. THE SIERRA NEVADA DE MÉRIDA

In contrast to Andean regions in other sections of the continent those in Venezuela have not poured forth a great flood of gold and silver; however, the intermediate elevations of these highlands have fostered the chief concentrations of population in Venezuela; most of the area shown in the picture consists of barren *páramo* about 12,000 feet elevation. (*Courtesy of Peter Christ.*)

it has never fully recovered. Actually 10 years of fierce fighting passed before the colony gained freedom.

EARLY INDEPENDENCE

Gaining freedom through the heroic efforts of Simon Bolívar, however, meant little more than precipitating the country into a deplorable state of seemingly perpetual revolution. The various sections of the country, cut off from one another because of lack of communications and differing in economic outlook, all sought control. Factions began the bitter internal dissensions which have astounded the world and which also have merited its ridicule. Since the final gaining of independence, not one president has reached office through election or left it without an accompanying revolution.

From the very first, the differences in geographic character of the Maracaibo Basin, the highlands, and the llanos showed themselves. Many a movement fell through because of the failure of one region to adhere to the others in policy.

In the early days, the unhealthful lowlands about Lake Maracaibo achieved little importance. Venezuela then embraced essentially two regions, that of the highlands and that of the interior plains. By the first part of the seventeenth century, noteworthy agricultural progress had been made in the fertile mountain districts. Especially about Valencia, Caracas and farther east around Barcelona, Indian and negro labor produced numerous crops: corn, potatoes, and at higher levels, wheat; bananas, sugar, and soon cacao and tobacco. Cattle also became of some importance. Development, however, soon reached a barrier because of the various trade restrictions. The llanos underwent a far different evolution. There cattle spread rapidly and a hardy type of plainsman arose—the *llanero*, offspring of the plain Indians and the Europeans—who was to play an important part in revolutions because of his horsemanship.

The benefits accruing from such growth, however, were almost completely wiped out during the struggles for independence. The armies required food and plundering became common. Between 1812 and 1823, Venezuela's cattle decreased in numbers from 4,500,000 to 250,000; the men who had cared for the animals suffered a similar decimation. The constant bickerings virtually strangled all efforts at progress and not until the dissolution of the political union with

Colombia and Ecuador in 1830 did the country begin a certain amount of advance. Though the strife continued, trade picked up; by the middle of the nineteenth century, cacao, coffee, and sugar had become established as important exports and cattle once more roamed the plains in great herds. Under the presidency of Guzman Blanco, who took office in 1872, the country prospered for 20 years. In 1896, on the other hand, started a series of sudden jolts: the boundary dis-

FIG. 274. THE FERTILE TÚY VALLEY, SOUTHEAST OF CARACAS

As throughout colonial times agricultural methods today in most of the republic are crude; neither the government nor the large landowners exert much effort to improve them.

pute with Great Britain, later complicated by the discovery of gold; a 2-year civil war; trouble with Germany and Italy resulting in a blockade of its ports in 1902. Again Venezuela fell into a hopeless muddle of petty political struggling, modified somewhat in 1910 by the installation as president of General Gomez. This man has exercised an absolute dictatorship since obtaining office and to a certain extent has freed the country of civil disturbances. His high-handed methods, however, and growing political jealousies point to his complete removal in the near future, and in all probability by another revolution.

VENEZUELA TODAY

With all this internal restlessness, then, where does Venezuela stand at the present time? An outstanding feature is that Venezuela

today is in an abnormal economic condition, owing to the tremendous rise of oil production, bringing the country to second place among the oil regions of the world. For the republic as a whole, coffee and cacao provide more reliable barometers of general conditions. On coffee particularly the prosperity of most of the population depends. Producing a bean of medium quality, the tree grows to perfection on the

FIG. 275. A STREET SCENE IN CARACAS

As many parts of Venezuela progress, Caracas becomes a modern city; it is connected with the sea by railway and paved road as well as with the leading agricultural districts of the highlands to the west.

hilly well-drained slopes of the mountains. In the Orinoco Basin, the significance of coffee and cacao is less because of the dependence on foreign markets of *balata,* hides and skins, beef cattle, heron plumes, and tonka beans.

As for the Maracaibo Basin, the paramount concern is oil, oil in ever-increasing quantities. Hardly touched in 1920, the Maracaibo oil region has experienced a meteoric rise in exploitation. The flood of "black gold" has profoundly altered life in the immediate region and to some extent that of the entire country. Although they signify less than the figures might indicate, exports and imports of Venezuela have quadrupled in the last 10 years. During this period coffee and

cacao exports have shown little change (Fig. 274). While it is true that the shipments of oil bring money largely to outside interests and that the greatly swollen imports represent almost exclusively equipment for the oil fields, nevertheless the country as a whole derives certain undeniable benefits from the situation. Not only does it receive augmented revenues, but thousands of men find work in the fields, and thousands more in the agricultural districts find new work in feeding corn, wheat, sugar, and beef to the rapidly expanding center at Maracaibo.

However great the production of oil, or even coffee and cacao, may become, Venezuela's future is restricted by the land's inability to attract immigrants. Practically all of the area suitable for future agricultural and pastoral development is hot, and in addition highly humid and unhealthful in many parts. Being such, these lands are unattractive to settlers of the type that Venezuela needs. In consequence, an actually vast area of potentially rich land must long remain undeveloped. These are fundamental and to a certain extent unalterable conditions; but in two other directions Venezuela can do much to further its own cause, namely, first the improvement of transportation facilities and second the setting up of a government sufficiently reliable to guarantee security to foreign investors as well as to immigrants. When a steady flow of immigrants, good interregional communications, and a public-minded government are normal parts of Venezuela's national existence, its great resources will give the country opportunity for a notable advance (Fig. 275).

CHAPTER XLIII

THE MARACAIBO LOWLAND

The lands about Lake Maracaibo have the distinction of being among the hottest and also the most wealthy portions of Venezuela. The former condition is due to their lowland position in a distinct basin in tropical latitudes, the latter chiefly to their resources in oil. But not all of the wealth comes from the productive oil fields, for the hot lowland plains present fertile soils which yield quantities of sugar and cacao, and in addition the thick forests covering the southern end of the basin give up considerable wealth in forest products.

Though conditions favored production of agricultural commodities desired by the early settlers, the region developed little consequence for many years after its exploration. The fierce Motilones Indians of the near-by Sierra de Perijá destroyed settlements and missions repeatedly, so that the land lay unutilized by the Europeans. With the extension of Spanish and later independent Venezuelan power, conditions improved, but the region continues one of average light population. Considerable areas are unpopulated, but in general the density of population is about 10 to 30 persons per square mile, concentrations occurring in the neighborhood of Maracaibo City and along some of the more important rivers, chiefly the Zulia and the Catatumbo—a principal highway to the rich southern mountain zone. As in other sections of the Caribbean and North Atlantic coast, Spaniard, Indian, and negro have produced a highly varied population, but here there stands out a conspicuous Indian group—the Goajiros. These Indians live in the semi-arid lands to the north of Maracaibo City and make up a group of almost 70,000 people. They are a pastoral and occasionally agricultural type of excellent characteristics. Many of the men are good workmen in the villages and in the agricultural districts about the lake, while numerous Goajiro women are employed as servants in the City of Maracaibo.

Maracaibo City is the commercial capital of the region and also the leading port of Venezuela. At one time, it bore little repute as an

unhealthful locality, but the riches coming from the near-by oil developments have transformed it into a rapidly becoming modernized metropolis of 100,000 people. It is located on a bay 20 miles from the sea and has a good natural harbor, which accommodates boats of only 11-foot draft. Bars in the 34-mile-long channel to the sea further hamper the city's shipping facilities. Nevertheless, it ships more than 60 per cent of Venezuelan exports and receives ap-

FIG. 276. RAIL TRANSPORTATION AT ENCONTRADOS

The Grand Railway of Táchira constitutes a vital connecting link between the coffee valleys of Colombia and western Venezuela and river transportation on the Catatumbo below Encontrados.

proximately one-half of the imports, serving as the commercial center for an immense area surrounding the lake, including the rich coffee district of Cúcuta, Colombia (Fig. 276); and it not only takes care of the country's principal exports of coffee and sugar but has become a center of attraction for foreigners and natives owing to the rapidly increasing exports of petroleum. Small, inland Venezuelan steamships cover all points on the lake, which has an area of 8,000 square miles. Small boats go up the Catatumbo River as far as Encontrados, near the Colombian border. Although traffic congestion is serious, harbor improvements will soon relieve the situation.

PHYSICAL CONDITIONS

In general only a few feet above the level of Lake Maracaibo, the surface of the lowland presents some variety, significant in relation to

crops, pasture, and forests. Around the southern end of the lake, reaching a width of nearly 90 miles southwest of the mouth of the Catatumbo, stretches a flat plain crossed by numerous meandering

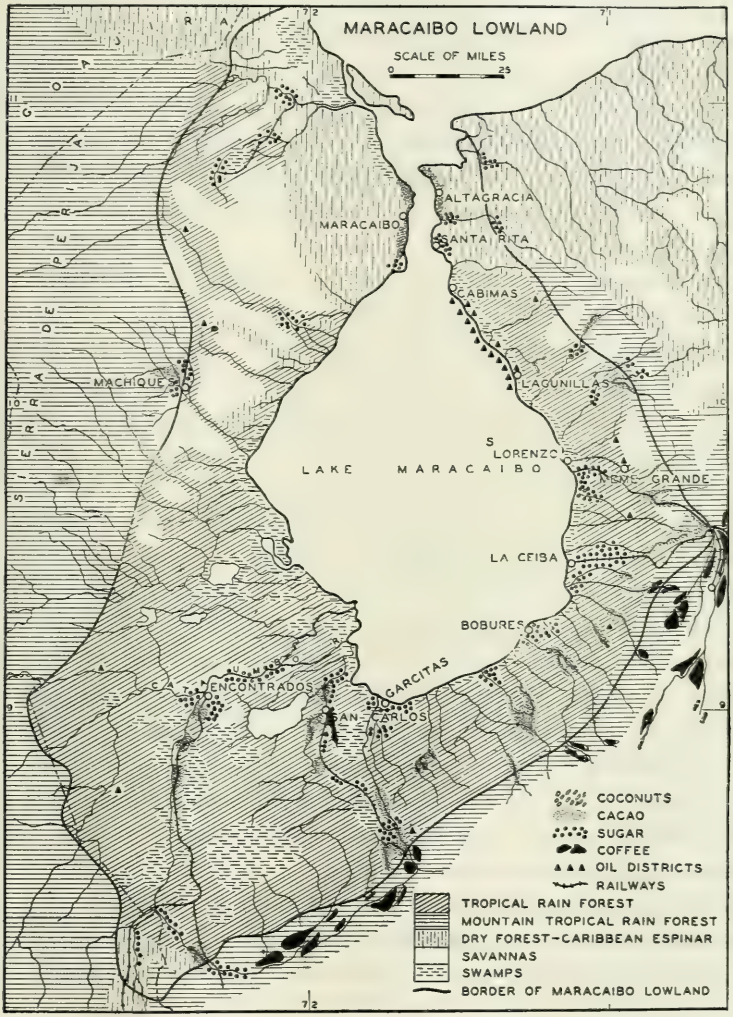

FIG. 277. VEGETATION AND PRODUCT MAP, MARACAIBO LOWLAND

streams and dotted with many large swamps; here vast areas adjacent to the streams are flooded periodically. To the north along low sandy plains possessing few river valleys and now and then rising a few feet in sandstone, hummocks border the narrows of the lake and

extend inland for 35 to 45 miles. On the border of these flat lands, a rolling hilly or ridge belt of varying width marking the outcrop of a bed of rock or the erosion by running water, rises gradually to the base of the several adjacent highland areas that stand out prominently as viewed from the lowlands. Almost entirely of recent marine or alluvial sediments the soil materials vary from the coarse sands and clays in the hilly belt through fine sands along the streams to silts and heavy clays in the deltaic deposits of the numerous streams. Where sufficient water is available, if drained, they produce abundantly. Elsewhere they present sandy wastes, savanna lands, or xerophytic woods (Fig. 277).

One of the hottest regions in South America, the Maracaibo lowland swelters under high temperatures most of the time. In general, temperatures range between 68° F and 95° F; different stations have average annual temperatures of 73° F to 80° F. These temperatures, combined with high humidity in many parts, promote vegetative growth but produce enervating conditions, especially during the middle of the day.

Not so uniform as temperatures, precipitation varies from almost none on the low sandy peninsula north of Maracaibo to 21 inches in Maracaibo City and to near 50 inches or more in the southern portion of the basin. Two rainy seasons, May-June-July and September-October-November, separate two seasons of almost no rains. The season of greatest rain extends from early September to early December; during the quarter—December to February—most of the region gets less than 2 inches of precipitation; Maracaibo receives one-half inch during this quarter. The amount and seasonal régime of rainfall affect vitally the type and distribution of vegetation as well as agricultural and other activities.

Along the narrows of the lake in the north for 25 to 30 miles, the dry, sandy, low plains support a sparse xerophytic vegetation of cacti, divi-divi (*Caesalpinea coriaria*), *algarroba* (*Hymenaea courbaril*), and other gnarled shrubs and trees. There is little grass; goats find difficulty in picking a precarious living from the drought-resistant growths; only along marshes do wiry grasses provide forage for cattle. Back of these reaches stretch narrow strips of dry wood lands having the giant *ceiba* (*Ceiba pentandra*), cedar trees and several palms, but very little underbrush and meagre forage except along marshes. Further

inland to the foot of the adjacent highlands extend the broad savannas, broken only by finger-like bands of trees on the moist soils of the river valleys or clumps of palms and other trees around the many marsh areas. The southern portion of the Maracaibo lowland presents a different aspect. Consisting dominantly of a tropical rain forest, it presents a great variety of species in a fairly dense stand. The forest solitudes and their Indian inhabitants release only patches for cultivation or broader areas here and there along the rivers and the few railway lines for pasture lands of *Pará* and *Guinea* grasses or on strips of especially heavy clay soils for native savannas invaded by only a few palms.

ACTIVITIES

Agriculture.—Crop lands, though producing a considerable variety, occupy mere spots in the vast Maracaibo Lowland. Many conditions restrict agricultural activities: aridity and sandy soils in the north; copious rains and imperfectly drained soils in the south; small and inefficient labor supply; hostile tribes, especially the Motilones dominating the vast area between the Rio Negro and the Catatumbo; many insect pests and diseases; inadequate transportation facilities and the lack of a market for the quality of articles produced. Crop lands consist of two types: the large plantations of cacao, sugar, coconuts (in the northern portion) and subsistence corn, cassava, and beans on the huge estates of the large landholder, and the small patch in a forest clearing of Indian or mulatto, who desire to produce only enough corn, cassava, bananas, breadfruit, pigs, and chickens to satisfy their gluttonous appetites (Fig. 278).

Cacao, almost absent from the northern portion for want of sufficient precipitation and humidity, finds in the southern reaches of the lowland auspicious conditions for rather extensive culture; deep sandy loam to clay soils of the natural levees and some interstream areas, abundant moisture and sufficient humidity of the long rainy season followed by a short sunny almost rainless season, constantly high temperatures, and an absence of any strong winds to dry the pods or to shake them from the trunk or the large branches. Offsetting some of their more favorable conditions are: (1) the rapid growth of fungus on the overshaded trees (all the plantations examined by the writer have from 10 to 25 per cent too much shade; even where new trees

have been replaced on old plantations few, if any, of the tall branching shade trees had been removed); (2) widespread leaf blight and black pod rot; (3) imperfect drainage in many groves; (4) small labor supply indifferent to the better methods of culture; (5) absentee plantation owners, for the most part; and (6) only fair methods of preparation combined with the tendency of the beans to ferment in the humid

FIG. 278. A NEGRO HUT SOUTH OF ENCONTRADOS

In the southern portion of the Maracaibo Lowland a few sugar estates and broad savannas break the monotony of dense tropical forests; with a pole-thatched hut surrounded by a patch of corn, cassava, and a few banana trees, the negro and Indian of the lowland prefer a life of leisure to one of hard labor on plantations or in the oil fields.

climate and under the slow methods of transport available. Most of the cacao plantations border the more navigable rivers, as the Catatumbo, Zulia, Escalante, and the three railway lines that cross the region. Established in the tropical forest by clearing out the trees, except those desired for shade, and planted about 80 to 100 plants to the acre, the trees begin to yield in about 7 years and then bear for 30 to 40 years. Most of the cacao grown consists of medium grade "criollo" type, nearly all the output being exported.

Sugar, grown on several large estates along the eastern and southern shores of the lake and treated in fairly large modern *Centrals,* enters

the export trade to the extent of several million pounds and is produced in small areas for the manufacture of coarse brown *papelón* or *panela*, the chief sugar consumed in Venezuela. In the districts of commercial production, sandy loam to clay soils of good humus content and fertility, a long rainy season followed by sunny dry weather favor the production of 40 to 50 tons of cane per acre, but the sugar content of 7 to 9 per cent is low. The fields once established yield several ratoon crops, with only surface cultivation, two or three times while the young cane gets a good start. Low-lying lands require expensive drainage, but irrigation is not necessary. Labor is scarce; all the districts breed malaria mosquitoes by the millions. Under favorable physical conditions the sugar industry of the lowland might expand materially with a better labor supply and a larger market; but it seems that Maracaibo sugar cannot compete with that from Cuba, Hawaii, and other regions in foreign markets, and a large domestic market awaits the replacement by refined sugar of *panela* in the upper class and mestizo population, a change in diet that may take place very slowly.

Cotton, produced in a small way in the sections adjacent to the lake south of Maracaibo and Altagracia, constitutes a minor crop. No large plantations exist; labor is expensive and inefficient. Though good cotton soils are found locally, small and uncertain precipitation deters expansion. Farther south too much rain and high humidity retard ripening and badly discolor the fibers. Mostly short, staple, upland American cotton is grown, being reseeded every two years; but facing competition from the chief cotton producing and manufacturing sections of the country, this district can witness little advance.

Coconuts in many large and small plantations along the shores of the narrows of the lake supply a commercial crop of some significance for coconut oil and copra. Under auspicious conditions the groves give good returns with little or no care for many years.

On the large cacao, sugar and other estates several crops, including corn, bananas, cassava, breadfruit, mangoes, and others are grown for local consumption as well as on the small cleared patches of the forest Indians and on some of the cattle *estancias*. As in all areas of primitive forest agriculture the crops, grown often among burned or girdled trees or between the rows of other crops, may be cleared of weeds once or twice during the season. This type of tillage can never

mean much to the region as a whole, beyond supplying the simple wants of these backward folk.

Grazing.—The grazing areas of the Maracaibo Lowland embrace three types in different sections of the region. In the northern portion, xerophytic forests with a very meagre growth of grasses provide poor forage for many goats, which pick a precarious living from the sandy wastes and provide the barest of necessities for the mestizo or mulatto owner dwelling in a mud hut and subsisting chiefly on the products derived from the herds. So dry is the area that few crops are grown; water for the people and the herds comes chiefly from holes dug in the beds of dry streams. Ranging within the confines of brush fences during the day, the goats are enclosed at night in stake or brush corrals near the house of the owner. Agriculturally naught else but an arid goat-grazing land can these sandy areas become.

In the north, bordering the goat-grazing districts, are the broad savannas broken at short intervals by strips and clumps of mesophytic arborescent forms. Here vast cattle estates embrace most of the land. Under the management of a mestizo major-domo the *estancias* graze cattle, goats, horses and mules in considerable numbers. They fare well on the native coarse grasses during the rainy season, but find scant forage at other times and also thirst for water. Of poor quality, few animals reach the lake markets on foot, but they supply quantities of dried beef and white cheese for adjacent lake marts and hides for overseas. Though these savannas will produce a variety of crops and fruits, the inhabitants subsist chiefly on a milk and meat diet; on many of the *estancias* a traveller would find it difficult, if not impossible, to procure fresh vegetables or fruit. Isolated, peopled by indolent Indians or mestizos and competing with better pastures elsewhere, these savanna areas promise little.

The third type of range land, in the southern part of the Maracaibo Lowland, borders the river highways, the railways, and the marshy, heavy clay belts. For miles tall *Pará* grass pastures break the continuity of tropical forests; they provide good grazing for low-grade cattle for much of the year; with river and rail transport the *estancias* of this district send thousands of animals to the lake markets each year. Though the ranges are fenced, little attention is paid to breeding or grazing; the whole area lacks one good dipping tank, but Texas fever is endemic; other diseases and pests take heavy toll. Many

cattle put on good flesh during each season, but the market, except for hides, does not extend beyond the lake towns and oil fields and the Dutch West Indies.

Forest Products.—The mesophytic and xerophytic forests, which cover most of the lowland, have given rise to two types of industries

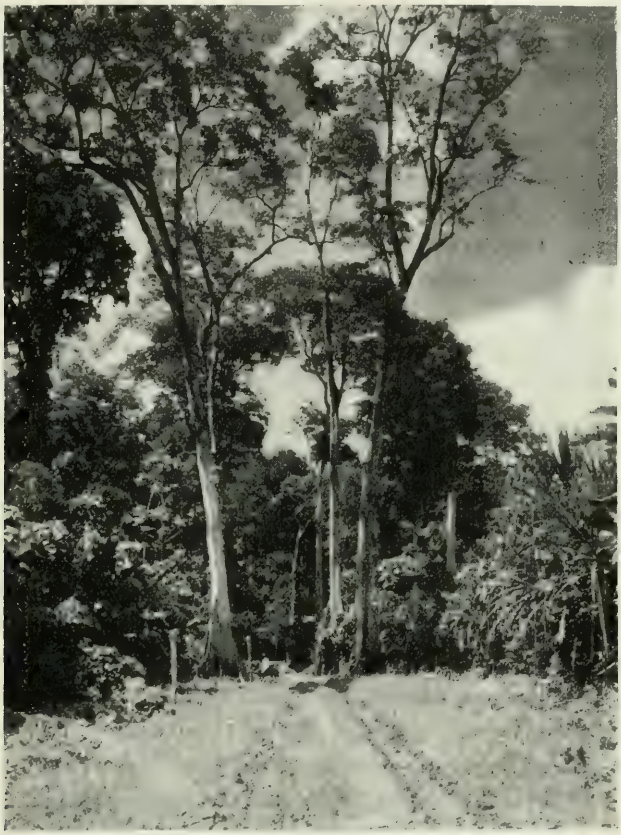

Fig. 279. Tropical Rain Forest, Maracaibo Lowland

(Fig. 279). In the former along the navigable rivers and railways of the southern part of the area mahogany, rosewood, ebony, and bastard *lignum-vitae*, cut and hewn into square timbers, are transported by water to Maracaibo, the chief lumber center of Venezuela. Lumbering consists of a primitive type, often carried on secondary to the establishment of a sugar, cacao or cattle estate. As the more accessible timbers are cut the industry decreases in significance. The

arid forests supply the pods of divi-divi and *algarroba* in variable amounts for tanning extract; in one or two places plantations of divi-divi have been established. But the forest industries, like crop production and grazing, promise little expansion under present conditions.

Petroleum.—Harbinger of prosperity, petroleum exploitation has arrived to line with gold the pockets of those who control Venezuelan wells. So rapid has been development that exports of the precious fluid for 1926 were less by only 850,000 barrels than the total shipments for all previous years, and in 1929 with a production of 136,000,000 barrels Venezuela was the second oil-producing country of the world; in 1927 the Maracaibo fields yielded 64,000,000 barrels, in 1926 some 37,000,000. Not only has this tremendous flow brought wealth to the foreign capital controlling production, but it has introduced profound changes in the economic conditions about Lake Maracaibo.

Practically all of Venezuelan oil originates in the Maracaibo region, both in and about the margins of the lake. Production centers in six fields: Lagunillas, a recent development which in one year sprang to the top in production, now giving almost one-half the total output; La Rosa, long the largest producer, but now second to Lagunillas, having its wells in the bed of Lake Maracaibo as at Lagunillas; Mene Grande; El Mene; Punta Benitez; La Concepción. So successful have been the drilling operations that nearly every well drilled in the Lagunillas field has produced abundant oil. Whereas in early 1926 the other fields were bending every effort to obtain greater production, at present the specter of overproduction threatens, chiefly the result of the bringing in of Lagunillas and of the insufficient facilities for transportation. Augmented tanker fleets, however, will allow an easy shipment of the oil. Already reservoirs for millions of barrels have been completed by feverish construction.

Oil development in the Maracaibo district has been beset by a number of serious handicaps, chiefly those of transportation (Fig. 280). The sand bar across the inlet to Lake Maracaibo has offered the most perplexing problem. To negotiate the passage, tankers have had to be built to order. They wait for the tide and cross the bar in fleets. Dredging of the bed is improbable because of the expense and the possibility of a secession movement on the part of Maracaibo, which is isolated from the rest of the republic and has industrious, thrifty

people who would be quick to profit by the great advantage of a deep-sea channel directly to the city. The expense and difficulties of constructing a pipe line to the ocean are decided hindrances. Consequently the method in use is that involving the transportation of oil to the ocean steamers by means of small tankers. Conditions will be relieved, however, by the construction of a new port on the Paraguaná peninsula and by the improvement of the port of Maracaibo.

Agriculture in this region is suffering keenly as a result of the attractions of work in the oil fields. So great a demand has there

FIG. 280. TANKERS TAKING OIL AT SANTA ROSA

Owing to the shallow water across the bar at the entrance of Lake Maracaibo, all of the oil produced in the basin moves out in tankers not drawing more than 11 feet of water; much of it goes to the Dutch West Indies for transshipment or refining.

been for labor that agricultural workers have abandoned the farms to accept employment with the oil companies. As farming declines in the region, the prices of foodstuffs go up by leaps and bounds. The long drought of 1926 and the consequent damage to crops further contributed to the movement. Influx of population, heat, insects, lack of modern accommodations, excessive prices, and port congestion have combined to make living conditions in Maracaibo, the regional center, unsatisfactory, but conditions are improving rapidly.

Until recently almost all oil production has been that of British-Dutch companies, although American companies now produce more than half the oil. For purposes of refining, the oil produced by the large British-Dutch group is transported to Curaçao (a distance of 267 miles). A refinery at San Lorenzo, connected with the property of Mene Grande, however, takes considerable amounts of oil. Exports

of gasoline are increasing, although the primary operation of the refinery is for domestic consumption.

For the next few years, petroleum promises to create significant changes in Venezuelan life. Through it, Maracaibo has become a place of prosperity, its water-front far livelier than at the times of its usual activity. But the withdrawal of thousands from the already sparse ranks of agricultural laborers involves serious difficulties. Agriculture suffers, prices continue to rise, and hasty legislation does little but create economic and political unrest and affect foreign purchases in the region.

FIG. 281. LAKE DWELLERS, MARACAIBO LAKE

In much of Maracaibo Lowland sanitary conditions must be improved considerably before the region can receive large increments of population; malaria is a constant menace; the per cent of intestinal diseases runs high among all the people; with the lake-dwelling people all traffic is by boat; houses placed on piles in the lake are free from insects and often mosquitoes. (*Courtesy of Herbert J. Spinden.*)

THE PROSPECT

The Maracaibo Lowland has possibilities for the best all-around development of the natural regions of Venezuela. Though the climate is hot, in return fertile soils abound; there exists a huge reserve of forest wealth; natural transportation facilities leading to the sea are unrivalled in the country; agriculture produces a variety of foods, from ground provisions to livestock to industrial crops; petroleum in plenty contributes a source of fuel. To all this may be added the proximity of the north coast to the United States and the growing interest of foreign capital in the region. It is true that petroleum for the time being may hamper the natural progress of the region, but in the long run the economic strength of the Maracaibo Lowland assures the establishment of an important section of Venezuela about the waters of its great lake (Fig. 281).

CHAPTER XLIV

THE NORTHERN HIGHLANDS

The Northern Highlands constitute the backbone of both Venezuela's topography and its industries. Stretching from the Colombian border for 600 miles eastward to the Paria Peninsula, they are the country's most prominent physical features and contain the bulk of the population. Owing to their altitude in low latitudes, the highland areas present a great variety of climates, soils, and industries, in consequence of which the region has become the economic heart of Venezuela. From earliest days the productiveness of the mountain valleys was appreciated and settlements proceeded from the low, hot, Caribbean coast to the more temperate elevations. Now, with but one important exception, here lie the country's largest cities—Caracas, Valencia, Barquisimeto, and San Cristóbal. Moreover, in view of its variety of conditions the region bears signs of considerable expansion in the near future, its specialty products of coffee and cacao finding a place in world markets.

In addition to the several political handicaps to the region's progress, the question of adequate means of transportation has deeply affected growth. An enlightened view of future needs, however, has given the region one of the most promising programs of road-building in South America. While railroad building encounters no such obstacles as the Andes of Peru, yet construction in the highlands has proved difficult and expensive; proximity to the sea has added to the comparative advantages of lower elevation. A good indication of the troubles besetting railroads is had in the brisk competition of mule-drawn carts or mule pack-trains with regular rail carriers. Another factor of serious import to the already harassed railroads is the energetic pushing of highway construction. Already a fine concrete strip parallels the railroad from Caracas to its port, La Guaira, and commercial houses have responded to its invitation by purchasing large numbers of motor trucks. Other roads extend lengthwise. So important is the newly opened Transandine highway that its influence

on shipping has already caused a decline in Maracaibo's shipping and a marked increase in that of Puerto Cabello, the port for much of the highland area. Kept in good condition by the government and traversable over its entire distances by trucks, this road extends from Caracas westward to Maracay, Valencia, San Carlos, Barquisimeto, Trujillo, Mérida, and San Cristóbal. From the last-named, it continues across the border to Cúcuta in Colombia and soon will be linked to a road from Bogotá. East of Caracas, no such services exist, owing to the strip of comparatively less productive terrain between the capital district and the lands about the far eastern Sierra de Cumaná.

While industries are quite similar throughout the region, except in the Segovia Highlands, where goat-raising displaces the all-important money crops—coffee and cacao—and the food crops—sugar, corn, and wheat—conditions of physical nature plus those of economic relations mark out three major geographic sub-regions. From west to east these are (1) the Sierra Nevada de Mérida, (2) the Segovia Highlands, and (3) the Coastal Ranges with subdivisions centering about the Lake Valencia Basin, Caracas and the Túy Valley, and the Eastern Highlands.

THE SIERRA NEVADA DE MÉRIDA

The mountainous terrain composing the Cordillera or Sierra Nevada de Mérida may be separated as the interior sub-region of the Northern Highlands, for none of its land touches the sea. It has no large centers of population, settlements being rather uniformly distributed, although San Cristóbal in the west, Mérida in the central districts, and Valera in the north—towns with populations of 21,000, 17,000 and 10,000 respectively—have considerable regional importance. Communications with the lowlands and Maracaibo—the port for most of the land—is difficult. One railroad system serves the rich coffee zone of the west, extending from Táchira to Encontrados or the Catatumbo River, whence river or lake steamers carry the produce. Two shorter lines serve the central and northern districts. Everywhere else the pack-train of mules is the universal carrier, and in view of the rugged topography as yet the most satisfactory one.

In general, the Sierra Nevada de Mérida consists of one main range some 250 miles long by 30 to 50 miles in width, and rising from

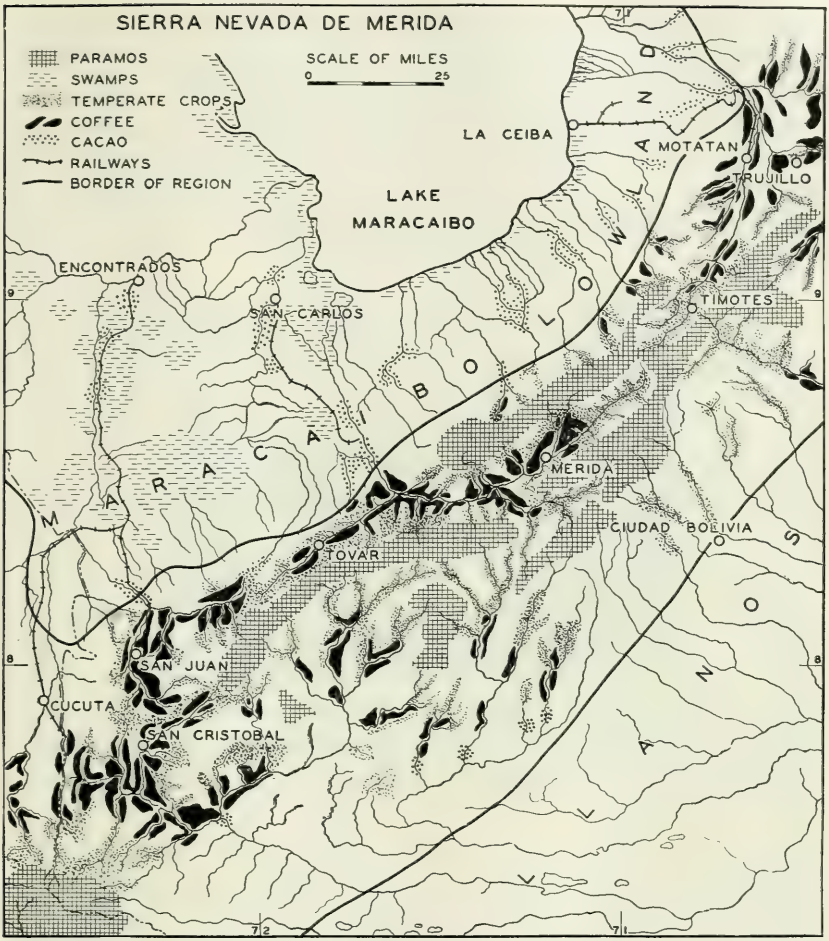

FIG. 282. THE SIERRA NEVADA DE MÉRIDA

In the highlands of western Venezuela the *páramos* and the high peaks above 9,500 feet stand out as prominent features of the landscape. Below the *páramos* temperate crops, wheat, barley, potatoes, etc., line the valleys and tint the hillsides. On the steep slopes from 7,000 down to 2,000 feet are the coffee plantations. In the valleys between the coffee plantations and below them are fields of sugar cane, corn, tobacco, bananas and, still farther below, cacao.

the low plains of the Maracaibo Basin or of the llanos to a perpetually snow-capped maximum height of more than 15,000 feet (Fig. 282). Into the sides of the mountain mass, streams have cut many deep verdant valleys, productive agricultural strips. The noteworthy range in elevations, and thereby climates, soils, and vegetation, gives the area a remarkable zonal diversification of products corresponding to altitude from bananas, cacao and corn to coffee, temperate grains, and, on the cold grassland *páramos,* livestock.

Owing to the variety of elevations, there exist numerous climates, the most significant characteristic of which is their temperateness. For most of the land, ample rains come every year, ranging from 40 inches to more than 75 inches, with a well-defined minimum, however, at the time of lowest sun. Certain small protected districts in the rain-shadow of parts of the range are exceptions to the general condition of adequate precipitation; likewise the cold wind-swept *páramos.* In accordance with differences in precipitation as well as the altitudinal decrease of temperature, natural vegetation shows striking contrasts. The lower northward-facing windward slopes are clothed in a dense forest merging with the tropical rain forest of the Maracaibo Basin. Between 3,000 and 6,800 feet luxuriates a rich subtropical forest including, in addition to many tropical species, tree ferns, oaks, walnuts, and the valuable coffee-shade trees—the *Inga.* This grades into a temperate zone of good timbers which at from 8,000 to 9,000 feet gives way to the cold grasslands; above the grazing zone and up to the snow line (about 14,500 feet) grow various hardy grasses, mosses, lichens, ferns, the woolly *Espeletia,* and some sprawling shrubs. Here and there in the lower valleys, where almost desert conditions obtain as a result of rain-shadow effects, natural vegetation offers a striking contrast to near-by lands; in some spots sterile soils produce similar effects.

Fertile sandstone soils, originally forested, support the principal agricultural areas. Expansion of the area in crops progresses slowly owing to difficulties of transportation and of light population. Nevertheless, the great natural qualities of the region have made it a leading agricultural zone in Venezuela, its productive valleys accounting for the bulk of Venezuelan coffee, in addition to many secondary crops. For the region as a whole, a notable feature is the temperate character of the crops.

With coffee, the economic life of the Sierra Nevada de Mérida is intimately concerned (Fig. 283). It is the one great staple money crop of the region, and inasmuch as its fine quality commands high prices its augmented cultivation is certain. Physical conditions especially favor the tree, but the same is not wholly true of methods of production. Deep soils on steep slopes assure the excellent soil drainage so vital to the plant. Rainy and dry seasons favor flowering, fruiting,

FIG. 283. COFFEE ESTATES NEAR SAN CRISTÓBAL

In the Sierra Nevada de Mérida, on the steep subtropical slopes physical conditions favor the production of good quality coffee, but owing to poor methods of propagation of the trees and of picking and caring for the crop most of Venezuela's coffee grades low.

harvesting and drying. Moreover, the deep valleys provide protection from drying winds or from winds strong enough to break the limbs of the generally heavily laden unpruned trees. In general, between the limits of 2,000 to 6,500 feet the higher the plantation the milder and therefore more valuable the berry; the upper level trees, however, give smaller yields and have shorter lives than those on the lower hot slopes, producing large strong berries, but they require less shading. Most of the coffee comes from large *fincas*, or estates, but a considerable quantity grows also on small plantations producing less than 100 bags, each generally of 101.4 pounds annually. The bulk of the crop is exported by rail or pack-train to the lowlands, thence by lake steamer to Maracaibo and from the port to the markets for quality coffee. The new Transandine motor road giving Puerto Cabello a chance at the coffee trade may cause a pronounced shift in

direction of shipments in the near future, since three or four transfers are required for produce leaving by way of Maracaibo.

Cacao is a second money crop for certain districts, but its exacting physical requirements restrict its production to particularly favorable places. These lie in the lower valleys, below an elevation of 3,000 feet, where constantly high temperatures, rainfall greater than 40 inches,

FIG. 284. TOBACCO DRYING BARN

Though physical conditions in the deep narrow valleys of sandy loam to clay soils favor the growth of a tobacco of high quality, poor methods of culture and preparation yield only a medium quality product.

prevailing high humidity, gentle winds, and good drainage encourage the tree's growth. For shade, the plantations retain some of the trees of the forest which is cleared for cultivation. Though the Sierra Nevada de Mérida accounts for a negligible share of Venezuelan cacao, its product surpasses that of eastern districts in quality.

In addition to coffee and cacao, the region produces a large variety of crops. Tobacco is an important crop in several sections (Fig. 284). Up to some 6,000 feet corn, beans, sugar cane, bananas, cassava, and breadfruit are grown in patches on every farm. Above this altitude, in a transition zone between 6,500 and 7,500 feet, these crops give way to several temperate kinds. For practically all of the agricultural lands, from the lowlands to 9,000 feet, corn is the staple food. Wheat

becomes important between 6,000 and 10,000 feet, although at the higher levels and on stony soils barley replaces it. Potatoes also add much to the food supply and grow to elevations of 13,000 feet (Fig. 285). For all of these and as well the abundant fruits, methods of cultivation are exceedingly crude and yields small and are likely to

FIG. 285. VALLEY OF RIO CHAMA NEAR MUCUCHIES

In the belt of temperate crops; in the lower right-hand corner of the picture is the stone-wall-enclosed threshing floor where cattle or horses tramp the grain from the sheaves.

remain so owing to the difficulties of exporting possible surpluses and the small labor supply.

THE SEGOVIA HIGHLANDS [1]

Although this sub-region has some of the oldest settlements in South America, it has a strikingly small population. Most of its area supports less than ten persons per square mile, a condition suggestive of the small present importance of the region to Venezuela. Only in the southeast, where rains and streams due to the near-by mountains permit considerable agricultural development, is the generally sterile aspect resulting from intense aridity broken. In that district lies the dominant center of population—Barquisimeto, a busy and old city serving as a point of exchange between the Sierra Nevada de Mérida

[1] Including the Paraguaná Peninsula.

and the northern lands. This hold upon trade is dependent to a large extent on the town's access to the railroad to the port of Tucacas, where launches are available to carry produce to Puerto Cabello. The line is the oldest comparatively long railroad of Venezuela, having been built originally to serve the copper mines at Aroa, but later extended and improved as far as Barquisimeto by 1877. Aside from the lands near the regional capital, the Segovia Highlands and the Paraguaná Peninsula consist of barren tracts grazed by a considerable number of goats, annual cultivation of crops being possible only under irrigation. For the industries of this larger part, Coro is the economic hub, its 16,000 people depending both upon the products of the sparsely peopled grazing areas and the town's strategic location on the neck of land joining the former Paraguaná Island to the mainland.

Most of the area, rising from 1,500 to 3,500 feet above the sea, consists primarily of a rolling to rough tableland. About its seaward margins the land grades into a zone of alternating mountain spurs and beaches. Inland, the plateau rises into the Sierra Nevada de Mérida. In the north three well-marked ranges stand out from the general level, the northernmost having an east-west extent of more than 100 miles. Farther south, the plateau drops into a broad depression drained by the Yaracuy River. Other streams have cut deep valleys into the margins of the plateau, where in some cases improved topographic conditions for precipitation produce a considerable rainfall, as in the Tocuyo Valley. Such favored localities produce coffee, cacao, sugar, tobacco, and subsistence crops.

Except for local differences, the main feature of the climate is its aridity, much of the region in appearance suggesting the Sonoran Desert of North America. Not only is annual rainfall small, most of the area receiving less than 30 inches, but high temperatures lessen the value of what may fall. The same great warmth, however, stimulates rapid growth when the rains come—generally from early September to December—or when irrigation is practised. Through most of the year, it is a parched land of dried pastures, wilting crops, withering vegetation, and thirsty animals. The common scene comprises a barren expanse of scrubby bushes and grasses above which here and there rise giant cacti, their gaunt forms casting a spell upon the repellent land. Among these growths graze numerous goats, and one of the trees—the divi-divi (*Caesalpinia coriaria*)—yields quan-

tities of tannin-rich pods. Elsewhere, especially on the northeast slopes, comparatively rich forests grow, producing lumber as well as serving as regulators of run-off for the Barquisimeto and Tocuyo Rivers, these the leading sources of irrigating waters.

Lacking important mineral developments—copper at Aroa in the southeast and coal near Coro in the north being small-scale producers when producing—such difficult physical conditions limit utilization of the land to a few agricultural industries. The entire region has only a few thousand acres of crop land, consisting of permanently cultivated (generally irrigated) and periodically tilled fields. The latter are the most extensive and depend upon years of heavier rainfall or upon dry-farming methods. The former lie in narrow patches along the streams or in broader areas on the alluvial fans, their greatest development being along the Barquisimeto, Aroa, and Tocuyo Rivers. Most commonly cultivated are corn, cassava, beans, sugar, and tobacco, and in a few places coffee, cacao, and coconuts. These crops receive a minimum of care after planting. Although production is not large, the paucity of population allows the export of a considerable surplus of corn to the Dutch West Indies in most years.

Beyond the crop-producing areas, the region is essentially a grazing-land, where even the voracious goats may find difficulty in picking sufficient forage. Despite the unattractiveness of the natural vegetation, the hardy animals manage so well that they prove very profitable. They furnish meat and cheese for a large number of people, while goatskins and manure make up significant items in Venezuelan foreign trade. In the high valleys and slopes about Carora-Burere, Siquisique, and some of the upper zones near Barquisimeto, cattle graze the better growths. Aridity closely limits expansion, the goats and cattle moving onto the more desert areas with the rainy season and retreating to the more moist districts and even to the irrigated pastures and stubble fields as the dry season withers all vegetation.

THE COASTAL RANGES

In several respects, this part of the Northern Highlands is the principal geographic region of Venezuela. Despite the fact that settlement here occurred much later than to the west, it contains most of the population of Venezuela and accounts for the bulk of the country's agricultural production. The concentration of population and

industries results naturally from two chief conditions: (1) the proximity of the temperate, though in part subtropical, highlands to the sea; (2) the rather extensive level and fertile interior basins and valleys (Fig. 286).

In response largely to the unattractive climate of the seaward slopes, the majority of the population lives south of the outer coastal range crest and on the whole is rather evenly distributed over the agricultural districts, averaging from 30 to 60 persons per square mile.

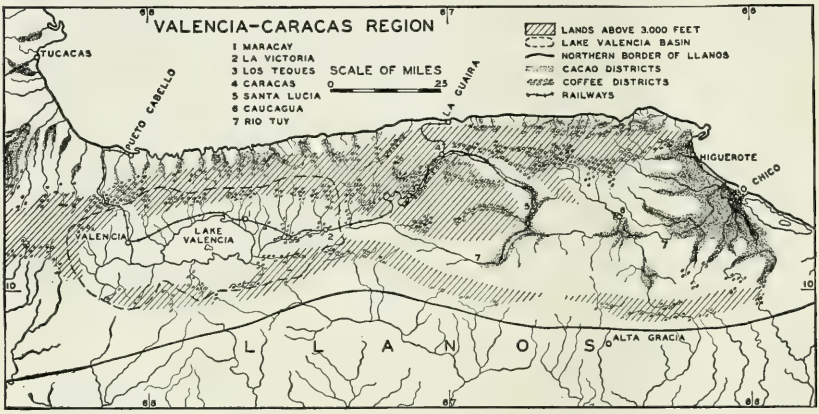

FIG. 286. THE VALENCIA-CARACAS REGION

Though cacao and coffee are the two chief commercial products of this region, large areas of land in the Valencia Basin and the numerous valleys leading down from the highlands are farmed in cotton, sugar, corn, and many other products for local consumption. The level Valencia Basin, with deep black to brown fertile soils, is one of the chief farming districts of all Venezuela.

Characteristically Venezuelan, the natives consist chiefly of the mestizos with a large proportion of Indian blood, although along the coast live numerous negroes. Caracas, capital of Venezuela and with 125,000 people, the most populous city, lies at an elevation of 3,036 feet in a depression breaking the continuity of the mountains. A strategic location with respect to the coast and routes to the interior make it the commercial center for a large area. It is connected with its port—La Guaira—by an expensive railroad, requiring 23 miles of track, perched for most of the distance on the side of a precipitous slope for an air-line distance of 9 miles. La Guaira was recently superseded by Maracaibo the second city. Its situation at an elevation of 1,577 feet gives it a climate far less healthful than that

of Caracas, but the great regional resources maintain its growth. Puerto Cabello, port for the Valencia district as well as for much of the Segovia Highland area, is connected with Valencia by a 33-mile-long railroad, built largely in a narrow gorge, which climbs to 1,952 feet. The harbor is Venezuela's best and at one time the port took care of most of the country's commerce. In the Eastern Highland district, population is comparatively light, the rather rich agricultural areas having as their chief towns Cumaná, Barcelona and Carupano with populations of 16,000, 11,000 and 8,000, respectively.

Like the other Andean districts, expansion is conditioned largely by means of transportation. New railroads or highways show their significance by promptly bringing about shifts in the direction of commercial traffic. In addition to the two railroads to the ports, there is a line joining Valencia, Maracay, and Caracas and one from the capital to the productive lands of the upper Túy Valley. Highways, particularly the Transandine Road, as well as those to the llanos, increase the facilities of the region. The eastern districts about the Sierra de Cumaná, however, still depend almost exclusively upon the mule picking its way along a precipitous trail, bringing produce to the small ports whence it is shipped to La Guaira or to Port of Spain.

Physical Features.—In its entirety, the region comprises two distinct mountain ranges and the intervening basins. Nowhere do the ranges rise over 8,650 feet, so that they are among the lowest of the Andean groups. On the west a low saddle separates these mountains from the much higher Sierra Nevada de Mérida, and within the region itself two notable structural breaks divide the land into three distinct portions: the break in which stands Caracas separates the Lake Valencia Basin to the west from the Caracas-Túy Valley district; the break occupied by the Gulf of Barcelona separates the latter from an eastern group of highlands.[2] In general the interior range is lower and not nearly so steep or continuous as that rising from the coast. Several broad gaps permit easy communication with the llanos. Two major east-west rivers drain most of the region. Into Lake Valencia flows the Aragua, in the valley of which lies Venezuela's richest agricultural districts. From the eastern section of the Valencia Basin,

[2] The several fractures suggest the great frequency of earthquakes over much of the region, the Eastern Highlands experiencing a violent tremor in 1929.

the headwaters of the Túy flow eastward, join those of the Guaire from Caracas, and continue into the Gulf of Barcelona; the eastern lands hold a particularly productive cacao region.

On the whole, conditions of climate and natural vegetation resemble those in the Sierra Nevada de Mérida, but there are some significant differences. The general lower height brings about a less temperate aspect, excluding any extensive development of *páramos* or of temperate grain-fields. In addition the coastal lowlands receive less than 20 inches of rain annually, as compared with the regional average of 40 to 50 inches, and almost equally intense aridity holds in parts of the

Fig. 287. The Arid Caribbean Coast

Below 2,000 feet most of the northern coast of Venezuela supports a meagre xerophytic growth of vegetation; in these areas only goats can pick a bare subsistence.

Sierra de Cumaná lying to the east. Up to as much as 2,000 feet in spots, the lower slopes support only a meagre xerophytic growth (Fig. 287). Heavy forests grow chiefly on the higher windward slopes of the northern range; the leeward slopes, interior basins, and southern range in the main have a savanna vegetation mingled with considerable brush of two types—the *espinar* and the *chaparral*, the former abounding especially in thorny plants.

Agriculture.—The variety of elevations as in the Sierra Nevada de Mérida results in a diversified agricultural economy, based chiefly on coffee, cacao, cotton, and sugar as money crops, but also depending to an important extent on secondary crops and livestock. Three districts corresponding to physical units stand out.

Lake Valencia Basin.—An extensive plains area, averaging some 1,500 feet in elevation, the Lake Valencia Basin is a region of great

agricultural value. Its fertile clay loam and dark brown soils produce a variety of important crops, while its less fertile districts support a flourishing cattle industry. It is the most thickly settled part of Venezuela (Fig. 288). To the west of the lake is the productive Valencia city district, to the east the more productive farms of the Aragua Valley, while the lands south of the lake have comparatively little agriculture.

Besides cultivating the cash crops of cotton, coffee, and cacao, the region is Venezuela's granary for corn and beans, these two staple

FIG. 288. THE COASTAL RANGE NEAR VALENCIA

The south facing slope of the Coastal Range bordering much of the Valencia Basin is clothed with a short growth of grasses; only along deep ravines do strips of trees replace the grasses.

crops growing in patches or considerable fields on every farm and being cultivated generally on the share system. In addition sugar, tobacco, rice, and many truck crops and fruits are tilled. The growth of the textile industry, particularly in Valencia, has stimulated the cultivation of cotton, so that this district produces more than half of Venezuelan cotton. As a rule, corn and beans are tilled between rows of cotton and pay for the expenses of cultivation and harvesting. On the higher better-drained slopes of the numerous tributary valleys, coffee grows so well that the area is Venezuela's second producer, ranking next to the Sierra Nevada de Mérida. As with cotton, labor shortages materially retard expansion. Below the coffee *fincas*, and at elevations around 3,000 feet, a considerable acreage grows cacao.

Cattle raising and pasturage also have an important place in the regional economy. Extensive grassy lake flats support some of the animals, but there are large fenced areas in planted *Pará* and *Guinea* grass. There cattle from the llanos are held for fattening, prior to

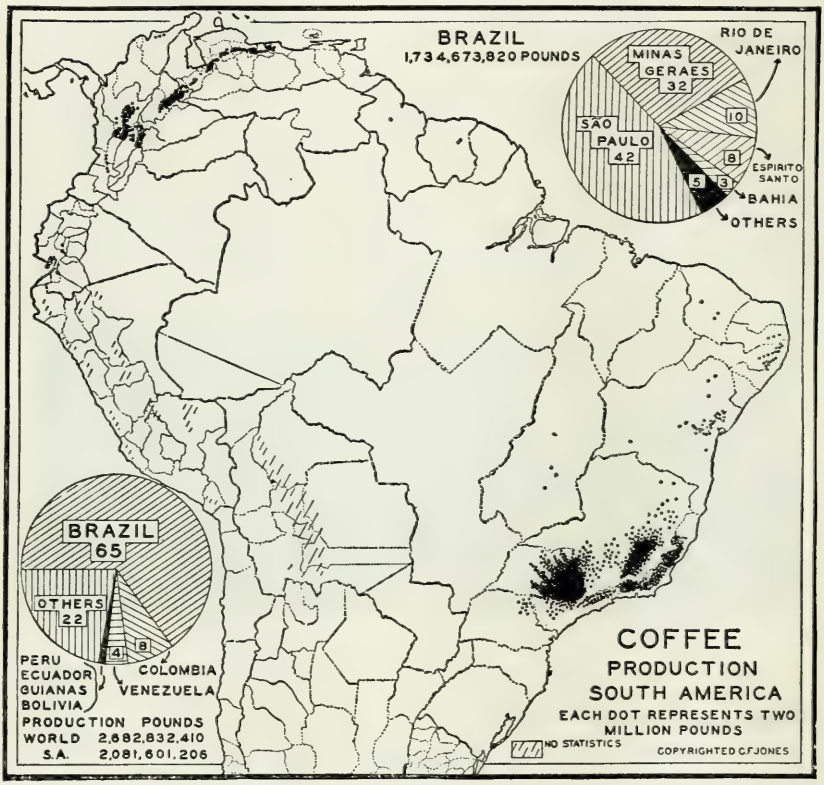

Fig. 289. The Distribution of Coffee Production in South America

Coffee production for the continent as a whole is concentrated in the Central Plateau of Eastern Brazil and in the northern Andes of Colombia and Venezuela. (*From "Commerce of South America," Clarence F. Jones, courtesy of Ginn & Company.*)

their shipment to the packing plant at Maracay, Puerto Cabello, or to Caracas. In addition, the region has developed several fine breeding herds of imported stock. Dairying has made great strides in recent years, owing largely to the interests of President Gomez, who is one of the wealthiest cattle-ranchers in the country.

Caracas and Túy Valley District.—This area embraces two complementary portions, the higher Guaire Valley, in which lies Caracas, and

the lowland hot Túy Valley. In the so-called "Valley of Caracas" the district has a populous agricultural area almost equal in density of population to the Aragua Valley. The lower Túy Valley, however, suggests the warmth of its low elevation by the light population and the considerable production of cacao.

Sugar cane, corn, and cattle hold the larger part of land in the "Valley of Caracas," but in addition coffee plantations spread over an extensive area to west, east, and on the outer slopes of the coastal range (Fig. 289). Eastward, the greater warmth, rains, and forests of the lower Túy Valley give rise to a major cacao-producing zone.

To the north of these two basins or valley districts the intermediate slopes of the coastal highlands comprise an agricultural zone of importance. On the barren, lower, seaward slopes of the northern range graze numerous goats, their meat, skins, and cheese adding to the agricultural production of the district as a whole. From 1,000 to 2,500 feet the steep slopes of the northward-facing valleys grow excellent cacao on the deep red clay but well-drained soils. Nearly every valley has cacao plantations, but those tributary to the port of Ocumare de la Costa, some 20 miles east of Puerto Cabello, lead in production. Here and higher up in the V-shaped valleys all along the range are productive large and small coffee *fincas*, favored by somewhat lower temperatures and greater precipitation.

Eastern Highlands.—Completely detached physically from the bulk of the Coastal Highlands, the mountain mass comprising the double peninsula of Araya and Paria and the Sierra de Cumaná duplicates on a smaller scale the features of the western sections. Population, however, is far lighter and communications poorer. Yet the district accounts for one-fourth of Venezuela's cacao, is the second cotton area, produces appreciable quantities of sugar, tobacco, coffee, and coconuts, and grazes cattle on the extensive grassy upland of the Sierra de Cumaná.

As in other parts of Venezuela agricultural methods are crude. On the cacao and coffee estates the sole implements include only the machete and a big hoe. Coffee yields per tree average low—about one-half pound per tree. No fertilizer is used; plants are not selected, new plantings being made from seedlings that spring up under the trees from dropped berries. The trees have too much shade. Diseases and pests do considerable damage. The berries—ripe and

green—stripped from the branches of unpruned trees by one stroke of the hand, yield an inferior to medium quality coffee with poor methods of preparation and grading (Fig. 290). Corn, cotton, sugar and other crops receive little attention, though in the Valencia Basin

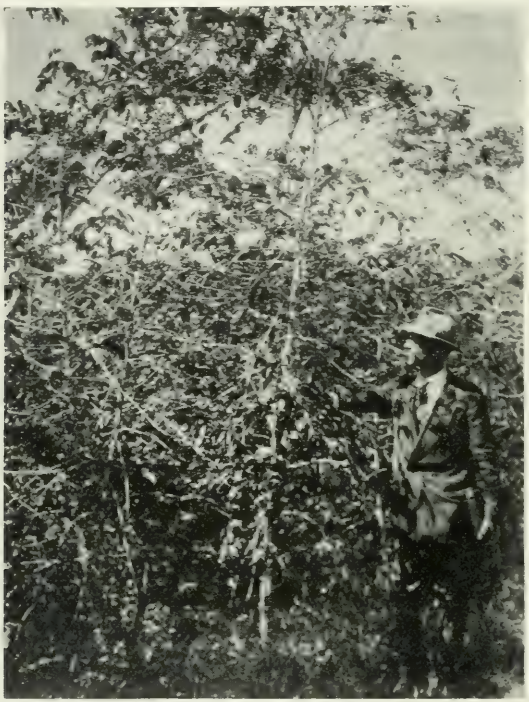

FIG. 290. UNPRUNED COFFEE TREE

In most of Venezuela coffee trees, seldom pruned, grow to heights of 6 to 15 feet; after a few years they contain a large percentage of non-productive branches owing to lack of labor and to a knowledge of better methods; coffee beans, both green and ripe, are picked with one stroke of the hand down a branch—these conditions do not favor the yield of a coffee of high quality.

some corn is intertilled. In spite of the fact that most cattle consist of inferior types little effort is made to improve the breeds; few owners dip for ticks. Agriculture suffers further by absentee landowners, poor unskilled laboring class attached to the estates, a shortage of labor as a result of attractions in cities, in the oil fields, and on road-building projects and by the lack of an expanding market for some of the surplus production.

MANUFACTURING IN THE NORTHERN HIGHLANDS

With respect to natural resources basic to manufacturing industries, the region has particularly favorable conditions. But as in virtually all of the Andean areas, the inadequacy of transportation facilities, the comparatively sparse population, and the general low purchasing power restrict activities. Certain industries, however, with the aid of governmental legislation, have achieved significant development.[3]

Its resources in fuels make the region conspicuous in South America. Coal of fair to excellent quality occurs in extensive beds near Coro and near Barcelona in the Naricual fields, as well as in smaller quantities in the Sierra Nevada de Mérida. The Coro and Naricual deposits furnish a small amount for consumption in the region. In addition to their coal reserves, the Northern Highlands have available the great oil supplies of the Maracaibo Basin and considerable hydroelectric power in the swift mountain streams. Iron exists in large quantities in several districts, but under present conditions the drawing together of coal and iron to establish an iron and steel industry is

[3] ESTIMATED NUMBER OF PLANTS AND CAPITAL INVESTED, VENEZUELA

Establishments or Products Produced	*Number of Plants*	*Capital Invested*
Sugar refineries	15	$ 7,000,000
Boots, shoes, and sandals	4 (a)	2,500,000
Tanneries	10	500,000
Breweries	5	5,000,000
Soft drinks	15	180,000
Textiles	10	10,000,000
Cigars and cigarettes	16	1,000,000 (b)
Straw hats	10	200,000
Cement	1	400,000
Rubber heels and combs	2	120,000
Chocolate	3	170,000
Glass	1	200,000
Paper	2	280,000
Sawmills	14	700,000
Matches	1	500,000
Petroleum refineries	2	(c)
Wire nails	1	75,000

(a) Represents only largest; many small establishments also included in capital estimates.

(b) One large factory represents half the total capital.

(c) Figures are not available.

Source: Randall, H. M. and Grab, F. D. "Industrial Development in Venezuela," *Commerce Reports*, Vol. I (1930), pp. 286–288, Bureau of Foreign and Domestic Commerce, Washington.

not feasible. The principal mineral exploitation is that of the copper deposits at Aroa in the Segovia Highlands, where mines have been worked for three centuries.

Major industrial activity centers at Caracas and Valencia, in response to facilities for shipment and immediate population. Cotton textiles are the chief manufactures for the district and the country; other cotton mills operate in Cumaná. Proximity of raw materials to market enables the mills to produce about half of Venezuela's requirements for coarser cotton cloth. The region's second industry is that of cigarette-making, also centered at Caracas. Other important enterprises include sugar-refineries, breweries, shoe factories, and dairies. The small sugar *centrals* in many sections of the region produce the brown cahi, *papelón* or *panela*, used by all classes. Much cane goes for the manufacture of rum. Aside from the factories at Caracas and Valencia, and the one cotton mill at Cumaná, the region has few important industries, most of the local necessities being produced on a small scale and are of medium quality.

EXPANSION

All expansion of agriculture, mining, or manufacturing in the Northern Highlands depends primarily upon the improvement of transportation and agricultural methods. For its size, the region has great diversity of important resources, which some day will serve as the basis for a far more advanced economy. In agriculture, its coffee and cacao enter an expanding market. The land capable of producing them is considerable, while sugar, tobacco, cotton, and the grains find natural conditions favorable enough to indicate a future production for export. Moreover, in these many agricultural products combined with the important mineral resources lies the opportunity for greatly increased manufactures. Foreign capital, which might undertake such industries, however, balks at the risks involved in operating under the prevailing political situation. Should certain governmental guarantees be set up, it is likely that the potential wealth of the region would lead to a rapid expansion of communications, and in turn a notable development of agriculture and industry.

CHAPTER XLV

THE LLANOS

Unlike the four other countries embracing both slopes of the northern Andes, Venezuela has virtually none of its territory in Amazonian plains like those of the Peruvian Montaña or Ecuadorian *Oriente.* Instead, there lies between the two highland provinces of the country an extensive plains savanna—the llanos. Though the llanos lack the richness of natural vegetation of the interior plains belonging to Colombia, Ecuador, Peru, or Bolivia, they have marked advantages, as illustrated by the early historical significance of the region; the plains lie near the sea, have a more healthful climate, and afford opportunity for easy communication.

Early adventurers had penetrated far into the interior by the end of the sixteenth century; but the fabulous El Dorado which they sought did not materialize. Subsequently came the first important utilization of regional resources in the introduction of a few head of Spanish cattle. Since its early origin, the grazing of cattle has been the outstanding occupation in the llanos and has placed its stamp upon the chief human activity in the region. Tillage of soil is sadly neglected. Imports of foodstuffs make up a considerable part of regional trade. Such crops as are produced comprise chiefly corn, beans, and cassava. The characteristic *llanero*—the inhabitant of the llanos—is every bit a herdsman. His long stay in the region has made him a definite type, destined to remain so far longer than his Pampa cousin—the *gaucho.*

Great size (approximately 100,000 square miles), an extensive cattle industry, and the comparative unattractiveness of lowlands in tropical latitudes are indicated in the sparseness of the population. Almost all of the llanos holds less than ten persons per square mile; indeed most of the area has less than two. Vast tracts, such as the sand dunes of the east and the swampy lands west of San Fernando de Apure, are practically empty of settlements. Concentrations of population are small, few, and far between (Fig. 291). The two chief

areas of settlement include districts along the Orinoco and its lower tributaries and the areas near the base of the Andes from Barinas in the southwest and San Carlos in the west to Maturín in the east. Ciudad Bolívar, the largest town, contains only 20,000 people. At a distance of 230 miles from the mouth of the Orinoco River, Ciudad Bolívar is the one great port for a huge hinterland comprising not only the llanos but also the Guiana Highlands of Venezuela. It stands

Fig. 291. The Sleepy Village of El Sombrero

The great expanse of the Venezuelan llanos has few important cities or towns but throughout the region at crossroads or river crossings stand small stagnant communities. (*Courtesy of Ernest G. Holt.*)

on an eminence on the left bank, where the Orinoco narrows to about a mile in width. It consists of low, thick-walled buildings with red tiled roofs and whitewashed walls; its streets are narrow, crooked and dirty, nothing green growing along them. Back of the city lies a great swamp. Its principal exports consist of cattle hides, live cattle, and egret plumes from the llanos, and *balata*, tonka beans and gold from the southern highlands. On the plains proper, the many small towns generally serve as district entrepôts. Of the group in which mingle the products of the llanos and Northern Highlands—Barinas, Guanare, Cojedes, San Carlos, and Maturín—the last named is the

largest, with some 15,000 people, and the scene of recent oil developments. In the important cattle zone of the Apure River lies another leading center, San Fernando; it is one of the hottest places in Venezuela and has 10,000 people; in addition to its interests in grazing, this is the center of the decadent egret plume industry.

While no widespread progress could be expected, however revolutionary the improvements, the region requires better transportation facilities than those now existing for a steady growth in importance. Two cart roads extend far into the llanos from the northern coast, one connecting Ciudad Bolívar with Caracas; but neither highways nor railroads pierce the region. Persons in Valencia or Caracas desiring to visit San Fernando or Ciudad Bolívar, take passage on a ship from La Guaira to Port of Spain and transfer to an Orinoco River steamer rather than brave the hardships of overland travel across the llanos. The Orinoco and its tributaries constitute the premier highway for much of the region. By means of this system, Ciudad Bolívar enjoys transportation over Orinoco water routes totaling more than 1,500 miles on which regular steamship service is maintained, and throughout the year it accommodates steamers of 12-foot draft. During the rainy season tributary streams offer navigable routes penetrating the frontier of Colombia. The waterways, however, are practically monopolized by the Compañía Venezolana de Navegación, which restricts navigation to boats flying the Venezuelan flag and owned by Venezuelans. Regular service is maintained with Port of Spain, Trinidad, where connections are made with ships for northern Venezuela and foreign points.

PHYSICAL SETTING

The plains of the Orinoco basin scarcely anywhere reach an elevation of 1,000 feet. Near the bordering mountains and highlands in the north and the southeast the land rises into rolling hills, but on the average the llanos comprise an almost level surface of alluvial materials comparable in point of relief to many parts of the Argentine Pampa. North of the Orinoco River a series of low sandstone mesas furnishes a major relief feature. Soils vary from coarse gravels, on the mesas and near the mountains, to fine silt loams and clays in the lower more distant portions of the plains. Impermeable clays underlie marshes in many areas, while in others sands and gravels cause droughtiness.

Whereas relief and soils tend to favor agricultural utilization, climate definitely limits possible development. Though the seasonal differences have caused the establishment of savanna vegetation thereby favoring grazing, at the same time, they constitute the principal obstacles to the industry. While the annual rainfall averages between 30 and 50 inches in one season—"winter," April to October—floods threaten the region; in the other season—"summer," November to March—the llanos thirst under a blazing sun. Warm throughout the year, in the dry season particularly, the plains experience terrific heat, slightly alleviated now and then by the persistent northeasterly trades.

FIG. 292. THE LLANOS NEAR EL SOMBRERO

The broad reaches of the llanos stretch for hundreds of miles with few surface interruptions. Typical Llanos palms and gallery forests along the streams. (*Courtesy of Ernest G. Holt.*)

The drought of summer gives predominance to the widespread cover of tall coarse bunch grasses and establishes the savanna character of the region (Fig. 292). The alluvial plains of the Apure River possess a more favorable stand of grasses and here has arisen the principal grazing district of the region. Only along water-courses and in rather large humid depressions to the west and north do trees find growth possible. Among the arborescent forms, two palms prove highly valuable to the native population. The northern plains have *Copernicia tectorum*, the south profits by its supply of *Mauritia flexuosa*. The former tree furnishes abundant material for thatching buildings, as well as for the making of straw hats, and the latter both thatching and construction supplies. But the chief wealth of the region, so far, has grown out of its stand of grasses.

INDUSTRIES

The Cattle-grazing Industry.—At one time regarded as among the most valuable of potential grazing lands, the llanos have fallen far short of producing a great cattle industry. Moreover, there exists little immediate prospect for an approach to even moderate development (Fig. 293).

In general, the llanos offer many attractions for cattle-grazing, for they are vast plains covered with grasses. In addition, the region lies nearer to Europe than Argentina by a full week. With the increasing need for crop land throughout the world, new grazing lands must be utilized, so that some degree of advance in the region seems certain, but natural and imposed handicaps abound.

During the flood season, rising waters force the cattle to the swells, from which they soon crop the available grasses. Many perish in the attempt to reach hummocks where the grasses have not been grazed. With the recession of the floods, immense swamps remain, breeding places for pestilential germs spreading diseases and death among man and beast. Later in the year begin the ravages by the tick. In a few months after the floods the land becomes drier, and under the warm, moisture-gathering trade winds, the plains soon experience a serious shortage of water. The grasses grow hard, dry, unpalatable, and unnutritious. Only during two short periods of the year do cattle get enough grass to eat. Then only irrigated pastures of alfalfa or *Pará* or *Guinea* grass can supply the needed fodder. The chief areas of artificial pastures lie in the zone adjacent to the Andes. From there cattle move on foot over the Andes to the coast.

Transportation routes and facilities interpose additional difficulties. To reach markets, cattle must be driven long distances. The major outlet is that through the low pass in the coastal range to Puerto Cabello. A domestic monopoly of pasture lands, at this point where cattle require fattening after the long trip, has effectually prevented the natural growth of foreign investment. The outlet through the gap in the low coast range to Barcelona and to Guanta is less difficult, but as yet the scarcity of fenced pastures hinders its general use. Large numbers of live cattle also leave the region by the way of the Orinoco River, via Ciudad Bolívar or Barrancas; many go to Trinidad and British Guiana.

FIG. 293. THE DISTRIBUTION OF CATTLE IN SOUTH AMERICA
(From "Commerce of South America," Clarence F Jones, courtesy of Ginn & Company.)

While in addition to the foregoing hindrances labor is scarce and unskilled, possibly the most powerful of the obstacles barring the way to the industry lies in political conditions. Grazing has suffered greatly from the political vicissitudes in the country's history. Introduced from Andalusia by the *Conquistadores* in 1548, cattle were allowed to run wild; and in colonial times grazing held an importance far greater than that of the present. A class of seminomadic herds-

FIG. 294. LLANOS CATTLE AT MARACAY

Many cattle of the llanos, consisting of tall, rough and bony animals, after being driven over long dusty routes and fed for some time on the pastures of the Valencia Basin, are moved to the great packing plants at Puerto Cabello.

men appeared, the *llaneros*, under whose care the herds increased rapidly; by 1812, 4,500,000 head grazed the broad grasslands. The wars of independence decimated the ranks of *llaneros* as well as the herds, and a notable decadence of the industry ensued; in 1823, approximately 250,000 animals remained. The surviving animals served as the nucleus for a period of growth interrupted, however, by a series of civil wars. In 1864, the llanos supported 6,000,000 cattle; 1873, 3,500,000; 1883, 8,600,000; 1901, 2,000,000; 1924, 3,000,000; they are generally of poor quality, and will require a long period of improvement to fit them for active competition on world markets (Fig. 294).

Farming.—For the llanos as a whole, farming is little developed. The laborers on each vast cattle estate barely produce enough crops for subsistence. The soil and climate favor a variety of products—

corn, cassava, vegetables and some fruits. But fruits and vegetables are scarce anywhere in the llanos. The chief food consists of meat of one kind or another. Insect pests, high temperatures, high humidity, and meagre transport facilities discourage farming. But some considerable farming districts have developed on the northern and western margins of the llanos—especially in the Barinas, San Carlos, Pao, Aragua and Calabozo districts. In some sections irrigation supplements the uncertain precipitation. Good crops of cotton, rice, corn, beans, cassava and vegetables grow by crude methods on the vast

Fig. 295. Bridge Across Rio Paya

This type of suspension bridge is used on some of the large rivers of the llanos, but most streams of that area must be forded; this can be done with ease and safety only during the dry season. (*Courtesy of Peter Christ.*)

haciendas of these districts. In the portion tributary to Valencia, farming advances most rapidly with cotton, rice and pastures. This indicates a line of development for much of the northern llanos when increased population and better transportation facilities provide an outlet for the products of the soil.

Egret Plumes.—At one time, the gathering of the beautiful plumes borne by the egret crane formed a major secondary occupation for the western portion of the region. So great was the response to a vanity demanding bird plumes most effectually obtained by killing the bird during the nesting season, that the industry suffered almost total extinction before the federal government took steps to check the inhumane slaughter. Now the birds may wade safely in the broad marshes, and registered collectors of plumes may take only those molted or broken off accidentally by the bird. Certain individuals have made attempts to secure the valuable feathers by farming the fowl

but the industry has not regained its past importance. Whereas in 1913 the value of exports totalled more than $600,000, today it aggregated less than one-sixth as much.

THE OUTLOOK

That the llanos face a near future brighter than their present condition is improbable. The grazing interests and the characteristic *llanero* seem not to mind the wretched conditions of life—little variety of food, bare necessaries, little medical attention, much sickness and suffering and blissful ignorance (Fig. 295). Foreign capitalists show a natural hesitancy towards investing the needed millions of dollars in a cattle or farming industry so liable to interruption by political influences. In recent years, the critical situation arising from the over-emphasis of development in the Maracaibo oil-fields has increased this disinclination to exploit the resources of the llanos, except at Maturín, where oil prospectors are opening up a new El Dorado. Though some large oil pools may be untapped, they are exhaustible and can usher in no permanent line of development for the region. Without capital, the handicaps of forage, flood, drought, pestilence, remoteness and labor assure the prolonged continuance of the unprogressive grazing industry of interior Venezuela.

CHAPTER XLVI

THE GUIANA HIGHLANDS OF VENEZUELA AND THE ORINOCO DELTA

More than half of Venezuela lies in the little-known land which extends south of the Orinoco River. A huge area of dense tropical rain forest interspersed with broad savannas, its 200,000 square miles (including the Delta of the Orinoco) encompass one of the still remote frontiers of white advance in South America.

THE GUIANA HIGHLANDS

Although its southern territories are the least utilized part of Venezuela, the country derives two comparatively important sources of income from the region. Guianan forest products and gold have long contributed materially to Venezuelan exports. Prior to economic exploitation, missionary zeal and military desire for domain brought some of the remotest parts—invariably along rivers, however—under a usually short-lived settlement. In most cases, the depredations committed by the Spaniards in search of riches or slaves brought about Indian uprisings which on many occasions resulted in total annihilation of the Spanish forces in certain localities.

The isolation under which the early forts struggled is still reflected in the exceptionally light population of the region as a whole. Except along streams and about the gold mine developments, the land is practically barren of permanent settlement. Including the fairly numerous, but generally tiny, villages of the rivers, the density of population is less than one-fourth person per square mile. The native Indian composes the bulk of this population. He too keeps to the rivers where he may reap the benefit of a highway front as well as enjoy a rich ever-ready harvest of fish or giant turtles, in addition to planting a patch of soil yielding food in abundance. If the lure of civilization grows strong enough, he becomes less attached to the land, but still employs the rivers to take him on his rounds devoted to the gathering of *balata,* rubber or tonka beans. Diminutive settlements have

grown up at breaks in mode of transportation. These frequently have an importance out of all keeping with their size. The capital of the territory of Amazonas, a state with an area of some 100,000 square miles, has a possible 1,000 people; nevertheless, the center—San Fernando de Atabapo—serves a large area from its site at the junction of the Atabapo and Orinoco Rivers. Ciudad Bolívar is the principal population grouping for the region, its strategic location at the narrows of the Orinoco giving it economic dominance over most of the area. River, pack-train, and foot-carrier bring here the varied products of the forest and the gold of the El Callao districts to mingle with the produce of the llanos and be sent out of the region. The second center of the region—San Feliz—lies about 80 miles below Ciudad Bolívar and serves the most populous portions of the territory of Bolívar; it has a population of 3,000. From this point the principal overland route of the region extends for some 200 miles southward to the El Callao district and on to tap the forest-products area about Tumeremo; the stretch of 200 miles may require from two weeks to two months of hard travel by cumbersome ox-cart—a typical characterization of land transportation in Venezuelan Guiana.

The region has considerable variation in land features, for it rises from sea level at the east to an altitude of 8,600 feet in the giant table-mountain of Roraima, at the Venezuela-Brazil-British Guiana boundary. Though deeply seamed in many places by swift torrents, the land may be designated as a plateau of moderate relief. The higher lands are tabular, frequently barren, sandstone areas bordered by extensive crystalline surfaces of irregular relief, here and there capped by volcanoes. The sandstone districts have occasioned much of the savanna land, while the soils weathered from the granites, gneisses, and diabase support a usually dense stand of forest.

Most of the region has a hot and humid climate, average annual precipitation ranging from close to 40 inches in the west to more than 80 inches on the Atlantic coast. Seasonal divergences in rainfall account in part for the rather large savannas which break the forest expanse. Owing to their elevation, these grassy areas are cooler and more healthful than the contiguous lands.

Much the greater part of the region lies clothed in dense and valuable tropical rain forests, reaching greatest luxuriance in the territory of Amazonas. In most respects—profusion of species of trees, epi-

phytes, leaves and undergrowth, and economic utility—they resemble the Amazonian forest. The principal forest industries, however, here depend upon resources different from those employed in the region to the south, but the difficulties of exploitation remain essentially the same. The savannas cover extensive tracts, but lack of population and transportation facilities prevent important development.

The Forest Industries.—Numerous valuable woods abound but are little exploited because of impure stands, insufficient stands, lack of transportation facilities and a sparse backward population. Only a few small shipments of cedar logs for Trinidad leave the region. On the other hand, *balata*, tonka beans, and chicle are important items of trade.

Balata (the gum of *Mimusops globosa*) is Venezuela's chief forest product and the leading export of Ciudad Bolívar. The tree occurs in scattered solitary specimens of groves throughout most of the forested area, but the principal producing districts are those of Tumeremo to the southeast of Ciudad Bolívar, where also lie the important chicle stands and the Amazonas territory. The crudity of methods used in tapping has wiped out the industry in many areas, but a realization of the value of this resource has prompted the enactment of strict regulative measures over all of the region, the enforcement of which necessarily leaves much to be desired.

Rubber from *Hevea brasiliensis* has declined greatly as a product of the forests. As in other parts of South America, wasteful methods have strangled the industry and it now exists only on a small scale in the upper Orinoco districts. Though this area holds one of the richest rubber regions of the continent, it suffers from tremendous handicaps imposed by distance from navigable waters; because of the numerous falls, parcels addressed from Ciudad Bolívar to the outposts of the rubber industry undergo transportation by nineteen distinct carriers.

The tonka bean, the extract of which is an important perfume base, leaves the region in large quantities, chiefly via Ciudad Bolívar. The tree (*Dipteryx odorata*) grows especially well in the north, in the valleys of the Caura and Cuchivero Rivers, near the Orinoco.

The forest exercises a profound influence over the life of the native. Not only does it provide labor through the year—gathering of *balata* and rubber comes in the wet season, of tonka beans in the dry season—but it also affords food, clothing, and shelter. Cultivated clearings in

addition produce chiefly yucca, cassava, sugar cane, plantains, bananas, and corn. But conditions of farming are most primitive. Crops planted among standing trees on burned over patches seldom get any cultivation. Weeds and insects take a big toll of growing crops, and weevil and humidity after they are harvested; so that in a productive land a food supply may be the chief problem of the inhabitant, almost at the mercy of plant and animal enemies.

Fig. 296. Headed for the Gold Fields

Everywhere along the margins of the old Guiana Highlands the streams have developed a series of falls and rapids crossed with difficulty; without more efficient means of overcoming these handicaps only valuable articles per unit of weight or animals that can walk to market, can come in large quantities from this region.

Gold Mining.—Practically every year since the occupation of the region by the Spaniards gold has been produced in Venezuela; and the metal yet retains importance, since it contributes about 3 per cent of the total value of the exports (Fig. 296). It occurs in nearly every state in the country, but the only mines in operation are those in the Guianan portion of the country near the Yuruari River. Known principally because of the noted El Callao mine, at one time the richest mine in the world, this region has been the scene of considerable development, much of it successful despite heavy costs of transportation to and from the Orinoco and remoteness from towns and supplies. El Callao was exhausted in 1895 after forty-two years of

operation with a total production of almost 1,500,000 ounces of gold; but several other mines have continued profitable development, although transportation and labor remain difficult problems. Most of the labor originates in the West Indies, but the lure of new strikes makes it difficult to hold laborers, as do scarce and expensive food and the dreaded malaria (Fig. 297).

FIG. 297. IN THE EL CALLAO GOLD FIELDS

Prospecting for gold in one of the small streams in the El Callao region of the Guiana Highlands of Venezuela. Only products of high value per unit of weight can be produced and marketed from this remote section of Venezuela. (*Courtesy of R. A. Liddle.*)

THE ORINOCO DELTA

The Indian life on the 9,000 square miles composing the delta of the Orinoco River exhibits a close and manifold response to local environmental conditions. In every phase of the daily life of the native appears the dominating influence of the great fluvial highway. The innumerable distributaries of the capacious river mouth afford a multitude of broad avenues on which the native plies back and forth in his dugout canoe. The flat interstream surfaces consist of gray alluvia supporting a particularly dense tropical rain forest. Physically, the delta stands out as a distinct unit; economically, it constitutes a tiny world apart.

The Guaraunos Indians, numbering some 9,000, carry on their activities practically wholly within the confines of the delta. In addition to the wealth of food afforded by the fruits of the forest, they reap a rich harvest of fish and turtles from the river waters and supplement this diet with cassava and corn raised on small patches in the forest. The forest provides also shelter and such clothing as may be worn. During the flood season, the forest Indian may raise a dwelling on piles, employing the trunks of the invaluable *moriche* palm (*Mauritia flexuosa*), a tree which also supplies the thatch for his hut, fibers for weaving, as well as shoots, fruit, sap and pulp for food.

THE FUTURE

The empire, encompassed within the 200,000 square miles of the Guiana Highlands of Venezuela and the Orinoco Delta, has little significance in present-day South America. Vast areas lie relatively untouched which are infinitely more attractive in the eyes of the settlers, despite a possible comparative poverty of native plant life. As in these other areas, also, the problem of transportation remains a serious one. The Orinoco lessens this problem to a certain extent, but only along a relatively narrow zone. In addition, the whole region lies between the equator and 10° N. latitude; the elevated savannas have a fairly favorable climate, but the lower lands which form the bulk of the land do not invite widespread immigration. Before adequate means of communication are installed and the handicaps of climate become less disadvantageous, millions of square miles in other parts of South America and the world at large will undergo profound development and advance. The region, destined to remain a remote part of the country of which it is a part, will continue as a land little known, and one in which native Indian, largely unmolested, will eke out a living and struggle against insect enemies and diseases

CHAPTER XLVII

THE GUIANA COLONIES

As the only European possessions in South America, the three Guianas have especial importance. Despite their connections with the mother countries over a period of several centuries, as a whole they are among the least developed parts of South America. In bulk they seem large, their combined area of 175,000 square miles being more than twice that of Uruguay; British Guiana alone is larger than England, Scotland and Wales together. Though with respect to total area the economic status appears low, such portions as are exploited have acquired considerable significance. Per capita trade, for example, amounts to nearly six times that of Ecuador, four times that of Venezuela, and almost three times that of Brazil and Colombia, countries in many ways similar to the colonies. Their total trade exceeds that of Ecuador by 50 per cent and is two and one-half times that of Paraguay. Of the three, British Guiana leads by virtue of resources and human energy; chiefly with sugar, diamonds, and *balata,* this colony accounts for 70 per cent of the total imports and for more than three-fourths of the exports.

Much of this wealth may be ascribed to the favorability of certain natural conditions, but on the whole greater importance must be attached to the overcoming of certain unfavorable factors as the basis for Guianan wealth in sugar, coffee, cacao, rice, coconuts, and numerous minor products. In this connection, the Guianas, more notably the British and Dutch portions, owe much to their relations with the mother countries. Without the capital forthcoming from England, Holland, or France, the hot, humid essentially swampy and unhealthful coastal strip composing the region would have remained simply a land to be avoided, a condition still holding in adjacent territory. As it is, however, the Guianan Littoral has experienced agricultural development over a period longer than for most parts of the continent.

Primary among all purposes of early European interest in Guiana was trade. In exchange for their hatchets, knives, trinkets, cloth,

and various minor commodities traders returned with tobacco, cotton, and numerous forest products. While here too there existed the wild story of El Dorado, other regions attracted greater attention. Yet the advantages of bartering sufficed to cause the settlement of trading factors to exchange products with the natives until the return of ships. Tobacco first engaged the interest of the Dutch, who were fond of the relatively new product; but soon European demands for sugar created several plantations, first established in Dutch Guiana in 1652 and a few years later in the northwestern districts of the present British Guiana. Slaves were cheap and easily fed on the abundant wild-plant foods, fish, and the prodigious yields of yams and sweet potatoes. For protection against French corsairs and English pirates the early estates were established several miles up the streams; but the land soon lost its fertility under the rigorous demands of the cane, and the Dutchman realized that he must begin diking the rich muck lands of the coast and the river mouths, so that to the present day the marginal lands present some aspects of the coast of Holland.

This early interest of Europe in tropical lands, as potential sources of sugar primarily, gave the original impetus to agriculture in these lands. On account of their adverse climate, the colonies had practically no indigenous labor supply. Hence the importation of labor began at an early date and from this immigration the bulk of the population and the chief features of agricultural production have arisen. For example, the East Indians, who now make up 42 per cent of the 300,000 people in British Guiana, not only furnish the labor for agriculture but they have installed rice as a leading commodity of domestic and foreign trade. In addition to the East Indians, the importation of whom has now stopped because of official prohibition by the Indian government, the colonies possess considerable elements of negroes, native forest Indians, Javanese, Madeiran, Portuguese, and some Chinese. Two unusual parts of the population are the Bush negroes of the interior and the convicts living in the penal colony in French Guiana. The Bush negroes live practically independent of white jurisdiction. Descendants of escaped and later freed slaves, they have taken up land in the inaccessible interior, where they have reverted to a plane near their original African barbarism. Dutch Guiana has several thousand of these, a group once so powerful as at one time to have endangered seriously the life of the colony. They

live in a primitive way, gathering food from the forests and streams, and also cultivating a few crops in fields rarely resown because of the rapid leaching of soils. As a whole, they are a stalwart lot, but they show no inclination to mingle either with white or Indian, and will long constitute an unassimilated group of Guianan population.

Except for the coastal strip of agriculture, the colonies show a strikingly low density of population. In the interior, only the activities of the gatherer of forest products, the miner, and the Bush negro break

Fig. 298. En Route to the Gold Fields of British Guiana

Though many rivers flow to the ocean from the Guiana Highlands, few of them offer good means of communication with the interior regions owing to the large number of falls and rapids interrupting their courses. (*Courtesy of the Yearbook of the British West Indies.*)

into the vast forests covering most of the land. Hence much the greater area holds less than two persons per square mile. The coastal lowlands, however, support a fairly dense population, though unusually large cities account for a good proportion of the total. The seaports Georgetown and Paramaribo far overshadow other settlements. Each has acquired great economic and political control over its respective colony. Georgetown's 55,000 people compose almost one-fifth of the population for all British Guiana, while Paramaribo with 40,000 has about two-fifths of that for Dutch Guiana. Cayenne, too, supports a large part of French Guianan population—13,500 of a total 50,000—but it possesses little significance in comparison with the two western cities.

Difficulties of transportation have been the greatest handicaps to development of the interior; in contrast, on the coast the ease of communication has aided greatly in the progress of the agricultural zones. Though many large rivers tap the interior for hundreds of miles, they are all interrupted by falls or bars at a short distance from the sea (Fig. 298). The Berbice, which is navigable farthest, accommodates vessels of 16-foot draft for 45 miles, those of 12-foot draft

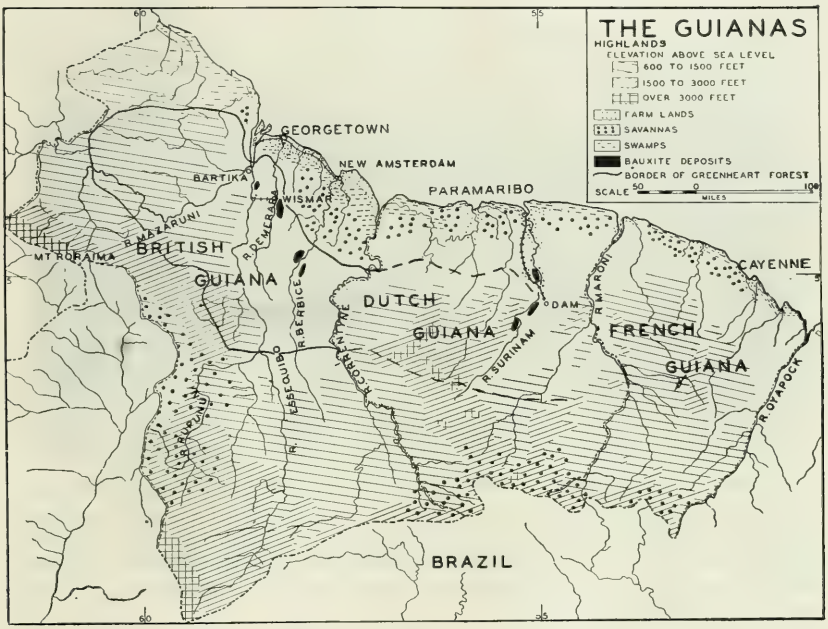

Fig. 299. Physical and Product Map of the Guianas

for more than 100 miles, and smaller crafts for 165 miles. Overland north-south transportation facilities are practically nil so far as concerns the interior. The sea front conduces to a lively coastwise trade, while Georgetown and Paramaribo are regular ports-of-call for many ocean-going steamers. The maze of canals used to drain the empoldered fields of the agricultural districts furnishes an additional and highly worth-while system of communication.

Most of the cultivated land lies in a flat wet coastal plain some 25 to 30 miles wide, which requires constant drainage of waters brought by rains, rivers, and the sea (Fig. 299). The soil materials of unconsolidated sands, clays, and humus have great depth. When properly

drained and freed from its impregnation of salt, the characteristic clay or clay-loam is exceptionally fertile. Rising slowly toward the interior, the alluvial stretch grades into a forested zone of sand and clay hills which parallels the coast from a few to 50 miles inland. The land gradually rises into the rolling plateaus of the south culminating in the Tumuc-Humac Mountains at the south and Roraima at the west. Most of the interior carries a heavy reddish clay almost totally

FIG. 300. THE CHIEF MEANS OF TRANSPORT FOR THE FOREST FOLK

As in other parts of South America, transport facilities constitute great handicaps for all lines of development in the Guianas; however, the tidal rivers below the falls and rapids at the border of the highlands accommodate large river boats and in some cases ocean-going vessels; in the picture the entire family, including the dog, is moving down the Demerara in a dugout.

forested; this soil is derived from the typical complex of granites, gneisses, and diabase making up the Guiana Highlands. Western sandstone districts hold only a cover of savanna, owing both to their soils and their climate.

Climatic handicaps are among the greatest deterrents to progress in the Guianas. Though in the interior the higher savannas have a less warm climate, the bulk of the area generally swelters under a blazing tropical sun and a muggy atmosphere. Most of the land receives considerably more than 60 inches of rain per year, with a generally drier season occurring about the time of the September equinox. The coastal belt frequently enjoys northeasterly or southeasterly trades which tend to alleviate the enervating effects of the

heat. Nevertheless, Georgetown records a yearly range in mean monthly temperatures of only 2.3° F, while at Paramaribo and Cayenne the contrast in seasons is even less.

Behind the marginal fringe of mangrove (*Rhizophora mangle*) and *courida* (*Avicennia nitida*), a natural and invaluable breakwater, the coastal plain supports a belt of marshy grasses studded with a few trees. This is the chief agricultural district, the drained lands having formed almost all of the cultivated area. Stretching far into the interior, the forests succeed the unforested coastal strip. For the Guianan they constitute a source of great wealth, second in importance only to the agricultural district, for in their depths lie not only the plant riches, but also the mineral resources in diamonds, gold, and bauxite. As in the Guiana Highlands of Venezuela, *balata* is the chief product. Unlike the western region, however, the Guianas obtain a wealth of timbers also from their forests, the greenheart (*Nectandra rodioei*), *mora* (*Dimorphandra mora*), crabwood (*Carapa guianensis*), and *wallaba* (*Eperua*, sp.), all proving of great value. As yet, though they cover several thousand square miles, the Rupununi savannas of the southwestern interior of British Guiana have little utility, owing to the lack of transportation means (Fig. 300).

Like all the northern lands of tropical South America, one crop, one mineral, and one forest product insure the economic significance of the Guianas individually and collectively. Utilized to great advantage, the fertile, rainy, coastal lands produce primarily the mainstay of the colonies—sugar cane—and in addition, rice, coconuts, limes, cacao and, to some degree, rubber. This zone constitutes the great agricultural region, the site of origin of all progressive tendencies, and the only portion of the colonies which may expect continued agricultural development for many years. From the forests the principal plant product is *balata*, though timbers assume constantly more importance. Of greater immediate value among the products of the forest zone are the minerals, chiefly diamonds, and secondarily bauxite and gold.

BRITISH GUIANA

First settled by the Dutch in the early seventeenth century, Essequibo, Demerara, and Berbice, at present the counties of British Guiana, have had a kaleidoscopic history. Long a bone of contention

among Dutch, English, French, and Portuguese, the English dependency, the major portion of which these counties comprise, has come to be the leading colony of the Guianas in practically every respect. In area it is larger than Dutch and French Guiana combined; in population it possesses a total 75 per cent greater than that of the other two; and in resources, potentialities, and economic activities it again surpasses these two South American outposts of western continental Europe.

During the several changes of dependency the colony experienced various shifts in agricultural production. With British control in 1796 Demerara and Berbice came to produce cotton as their chief export, but for only a few years. In 1807 the heretofore flourishing slave trade ceased by the official abolition of the traffic, and prices for cotton dropped as a result of competition with the southern United States. Sugar proved more profitable; slaves were removed to sugar plantations, and hundreds of cotton estates were abandoned. Production ultimately fell to nothing, a condition which has existed to the present day except for a few attempts at reviving the industry despite the scarcity of labor. Coffee too, though early produced in abundance, gave way to sugar for want of a continually augmented labor supply. On the other hand, cacao, coconuts, and rice came into prominence and have continued to be of significance in trade. Numerous forest products also have swelled the total; and after many efforts to locate paying gold deposits successful operations were commenced in British Guiana in 1884, many years after those of the Dutch and French. Diamonds and bauxite too have been recent, but very fortunate, developments.

Sugar.—Sugar cane (51,000 acres) occupies more than one-third of the cultivated land in British Guiana. Dependent upon this crop is the prosperity of the colony, yet the industry has progressed little in late years. A number of conditions favor production: ample precipitation, the drainage facilities of a plantation being among the operators' chief problems; abundant fertile land; excellent means of transport between field and mill by means of the numerous drainage canals; manufactured sugar of excellent quality enjoying Canadian and British preferential tariffs. On the other hand, a set of difficulties has from time to time almost overwhelmed the industry. Much of the land comprising the estates lies below the level of high tide. Conse-

quently behind the natural barrier of *courida* or mangrove a dam of earth must be constructed to form a further barrier against the sea. Next to the front dam comes a small strip of grasslands used for pasturing a few horses and cattle, intersected by either a public road or railway, on either side of which extends a canal; these fields are crisscrossed by numerous trenches (Fig. 301). In many cases the area occupied by dams and trenches amounts to 10 per cent of the total area of the plantations, which extend back lengthwise from the river

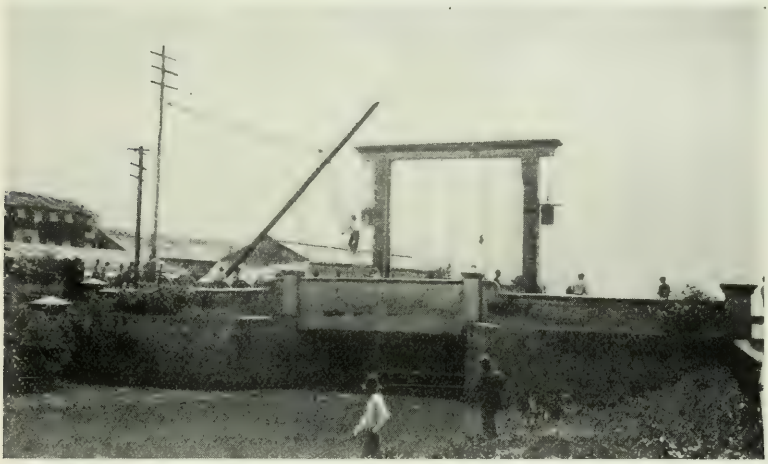

FIG. 301. A LARGE DYKE GATE

The chief sugar lands in the low, flat, coastal plains of British Guiana must be protected from the invasion of the waters from the sea by a sea wall and large dyke gates; at low tide the gate is lifted so that the water may drain off the land into the sea.

or sea in rectangular blocks, and an additional dam guards against floods from the land. The innumerable drains crossing the fields preclude the use of large machinery, a most unfortunate situation in a region suffering from a dearth of labor. Manual labor serves therefore for planting, cultivating, and harvesting. Furthermore, the industry has had to face declining prices and very effective competition.

Though the number of estates and total acreage have decreased greatly, annual production has hovered about 100,000 tons for more than 50 years; in 1825, 200 estates existed, in 1926 less than 40. In order to meet the stiff competitions, methods of manufacturing are most modern, each large estate producing its own sugar and sugar by-products. Of the latter, rum is of greatest value, followed by molasses

and a cattle feed made of low-grade molasses mixed with alfalfa and bran—molassciute. Commonly, the planters obtain one direct and one ratoon crop. Following 10 or more years of planting, the soil

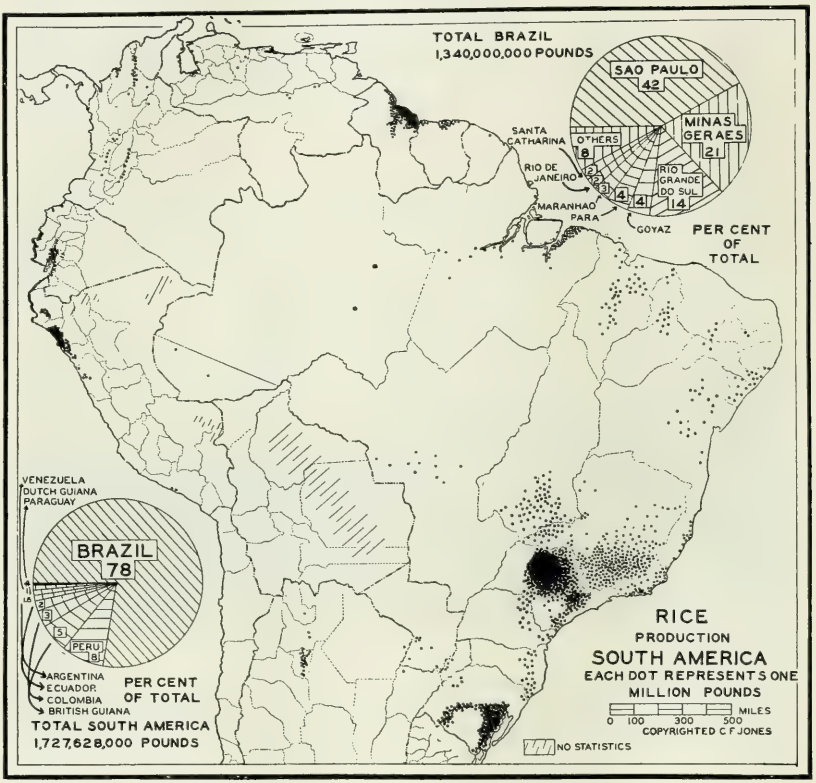

FIG. 302. DISTRIBUTION OF RICE IN SOUTH AMERICA

Though rice is produced in many parts of tropical South America a number of important areas stand out—the Coastal Lowlands of the Guianas, the Highlands of East Central Brazil, the north Coastal Desert of Peru, the Guayas Lowlands of Ecuador, and the Magdalena Valley of Colombia.

generally becomes exhausted. To restore the productivity of the soil fertilizers are rarely used. Instead, fields are flooded for 6 to 12 months, the land then is drained, and cropping begun again.

Rice.—In the early 1870's, British Guiana had a yearly import of more than 30,000,000 pounds of rice. Today, the grain has proved so well adapted to the physical conditions of the coastal savannas, that it not only supplies all regional needs of the Indians in Demerara and

Javanese in Surinam, but holds an important place in the British Guianan export movement.

Large areas of land possess the requisites of rice production: heavy rainfall, warm climate, good irrigation facilities, and excellent soils (Fig. 302). Labor is not so serious a problem as in the case of sugar, since the rice is cultivated chiefly by the small farmers, and the East

Fig. 303. An Excellent Rice Field in Coastal British Guiana

The large East Indian element in the population of British Guiana contributes greatly to the expansion of rice culture and consumption.

Indian feels at home in the rice fields. Many of the small farmers rent portions of abandoned sugar estates in order to plant their rice on the flat, heavy lands which in the long years of cane cultivation have developed an almost impervious subsoil, an important factor in the cultivation of rice.

First introduced early in the eighteenth century, rice soon came to be cultivated in many districts, although on a small scale. Its excellent keeping qualities and its high yields created a demand for the grain, especially as a food for slaves. Up to 1886 the area given over to rice production remained small and lay in separated districts of the Essequibo, Mahaica, Abary, and Canje Rivers. At present, the

principal areas lie on Wakenaam Island and on the coast from the Supenaam River to Hampton Court. Acreage averages some 30 per cent of land in crops (Fig. 303).

Although most of the grain comes from small farms, large-scale operations have begun. These resemble the methods in use on the machine-cultivated rice lands in the United States, and effect a decidedly worth-while economy of labor.

Minor Agricultural Products.—Coconuts play an important part in the agriculture of British Guiana, the trees growing on more than 30,000 acres. They flourish and bear prodigiously on sandy coastal soils, although frequently hurricanes lay waste over large areas. Also, the diked coastal lands lack the proper movement of ground water to insure the most healthy growth of the trees. Most of the nuts come from small estates and supply domestic requirements for coconut oil and cattle feed, the former of which is consumed in great quantities by the East Indians.

At one time in the 1830's, Demerara exported 10,000,000 pounds of coffee per year. The berry was of excellent quality, but the destruction of a labor supply by the emancipation of slaves caused the decline resulting in a production barely sufficient for local demand.

Additional crops include cacao, which, although of excellent quality in the lower valley zones, occupies only 2,000 acres; lack of capital is a major handicap. Limes and other fruits climb rapidly, the former already having passed cacao in importance. As to provisions, the laboring classes supplement their important dish of rice with the yam, cassava, sweet potato, plantain, several indigenous legumes, and various vegetables like tomatoes, egg plants, and okra.

The raising of livestock claims little attention in British Guiana. Large areas of the coastal savannas can support cattle and a few animals do graze the grasses. Most of the cattle are highly mixed, a goodly percentage having *zebu* blood. Water supply raises the chief obstacle, for in the rainy season pastures are flooded, cattle often grazing more than knee-deep in the water; and in the dry season frequent shortage of palatable water occurs. Cattle shipped in from the llanos compete in the markets of the coastal districts with cattle from the near-by savannas.

The interior savannas, especially the Rupununi savannas, occupy large areas, have fairly good grasses, and support several thousand

head of cattle. But as a whole they are undeveloped. Cattle moving overland and down the rivers to the coast arrive in very poor flesh; often little more than skin and bones, they are barely able to brush the flies off with their tails (Fig. 304).

Diamonds.—Diamonds produce more than one-fourth the value of British Guianan exports; they are far and away the second commercial commodity of the colony. Situated in an almost inaccessible district, the Mazaruni diamond fields rank next to those of Africa. For

FIG. 304. CATTLE IN COASTAL SAVANNAS

The tall rough cattle from the interior savannas of British Guiana, even if in good flesh when they leave the pastures for the coastal districts, arrive in very poor condition; so great a handicap does transportation from these distant lands constitute, that beef from the llanos in Venezuela can be brought to Georgetown cheaper than from the interior savannas.

a long time, the production of the gems was merely incidental to the exploitation of placer gold, systematic development dating only from 1900. Today Georgetown ships about 180,000 carats yearly, valued at more than $3,500,000.

Production goes on under many difficulties, the most troublesome of which may be removed by the inauguration of an intended airplane service between Georgetown and the Mazaruni district. By the usual river routes the trip occupies between 20 and 26 days, according to the condition of the rivers. Furthermore, the entire area is covered by a dense tropical forest, through which progress is difficult and slow; malaria too is an ever-present menace. Only the negro possesses a constitution robust enough to stand the rigorous condi-

tions of life in the diamond fields, where green vegetables and fresh fruits are totally lacking and where very poor sanitary conditions prevail. Inasmuch as the market for diamonds is fairly restricted, the industry can expect no sudden increase in the near future. Although it has been the most flourishing activity in British Guiana during recent years, it too now experiences a slight curtailment of production as a result of lower prices and a variety of difficulties.

Bauxite.—The world's increasing demands for aluminum products

FIG. 305. THE BAUXITE MILL AT MACKENZIE

From the interior of British Guiana, a day's sail up the Demerara, come large quantities of bauxite annually; left to right, washing, crushing, and conveyor buildings; the bauxite coming in by rail from surface mines a few miles in the tropical jungle after being crushed, washed and dried moves on ocean-going vessels from the conveyor building on the right to consuming regions in the United States. (*Courtesy of the Yearbook of the British West Indies.*)

have given British Guiana a source of income of constantly enhanced value. Less than twenty years ago, the colony's deposits of bauxite had no commercial significance, whereas today exports of the valuable ore amount annually to 175,000 tons. The principal fields lie 80 miles from the mouth of the Demerara River and the ore-handling plant of 300,000-ton capacity lies about 10 miles down stream at a point where steamers of 16-foot draft may load directly (Fig. 305). The deposits are covered with a dense forest and an overburden of 10 to 30 feet of sandy clay which is removed by steam shovels following cutting of the forest. In addition to modern methods employing

steam shovels and explosives, the mines use negroes and forest Indians for labor, avoiding the less robust East Indian. Though paid but ten cents an hour for a ten-hour day, labor sticks to the mines, for the operators have constructed a beautiful town for their force. Disease is rare and proper food is always available.

Gold.—Gold has long been a lucrative field for exploitation in British Guiana. Not until the middle of the nineteenth century, however, did operations assume much importance. Rich lodes and occasional huge nuggets led prospectors on into the fields of the Potaro, Cuyuni, Barima, and Essequibo Valleys. Production reached a peak in 1893 with an output of 139,000 ounces. Since then a marked decline has occurred; production today totals less than 10,000 ounces per year.

Numerous factors have contributed to this decline. Whereas the possible resources are large, the principal alluvial workings, from which the bulk of the metal comes, show signs of exhaustion. The fields are difficult of access, prices of necessary articles are high, and transportation of required machinery for large-scale exploitation demands prodigious efforts. Furthermore, a general apathy toward working in the gold fields has arisen; no sensational finds have occurred recently, with the result that the villagers seem content to tend their farms. Because of frequent incompetence or dishonesty on the part of the leaders of small expeditions local capitalists have withdrawn their support in many cases. Finally, the greater lure of the diamond fields has supplemented the effect of handicaps connected directly with gold.

Forest Products.—While the forests are among the richest resources of British Guiana, the difficult conditions of development render more than 87 per cent of the country's area of decidedly minor importance. Less than one-twentieth of the exports is obtained from the great forests. Like other forested areas of tropical South America, exploitation suffers from lack of means for transportation, impurity of stands, and labor difficulties.

Though losing importance in recent years, *balata* is the leading forest product. With a group of Indians generally, a white supervisor enters the forest to begin the arduous task of tapping the trees and preparing the sheets of *balata*. The laborers may remain in the forest for months or years, paid little, and liable to a multitude of

dangers including poisonous snake bites, insect pests and malaria.[1]

Greenheart, one of the most resistant timbers, is the most valuable wood product (Fig. 306). Its ability to withstand immersion in water for a long period gives it great value; British Guiana is the world's only noteworthy source of the timber. The logs are cut and squared in the forest by negroes or mixed negroes and Indians and, owing to the wood's high specific gravity, shipped downstream on large punts or rafts on which they are braced with lighter logs (Fig. 307).

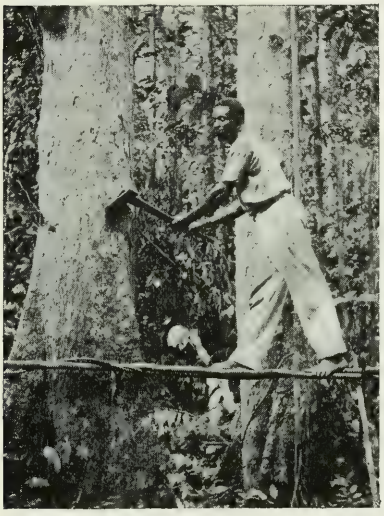

Fig 306. Felling a Greenheart Tree

While many valuable dyewoods, resinous trees, cabinet woods, and other timbers exist, they are little utilized; in the whole country there are 22 power sawmills and 5 woodworking factories. Domestic consumption takes care of small quantities of hard woods for construction purposes, slightly softer woods for shingles (usually of wallaba, the most abundant timber), and various types suitable for fuel.

Manufacturing.—British Guiana has little industrial development other than sugar and cacao factories, rice and oil mills, sawmills, and tanneries. Most numerous among the factories are cigar-making establishments. Consequently, except for minor quantities of boots and shoes, matches, baked goods, and tobaccos, all manufactures come from abroad. Georgetown and New Amsterdam receive electric illumination, while the former also enjoys the facilities of street-car service. No considerable expansion can be expected for some time, for despite the relative abundance of wood for fuel the industries would face a small population and the enervating heat.

[1] The work of the *balata* gatherer is hazardous and exceedingly trying. Often bitten by snakes the men die if not treated shortly after being bitten. The streams are full of *Paranhias,* a dangerous fish It is common to have three or four men bitten by them each day when a group of fifteen to twenty men are on the march carrying *balata* to depots. The chief delivery season coincides with the rains and swollen rivers. While the bite is not fatal, some men bleed to death; many wounds become infected and the victim succumbs.

DUTCH GUIANA

Smaller in area and population, less abundantly supplied with natural resources, and hampered climatically by physiographic conditions which prevent the refreshing trade winds, so welcome in British Guiana, from sweeping over the most densely inhabited agricultural area, Dutch Guiana in almost every comparable respect is inferior to its western neighbor (Fig. 308). Nevertheless it produces several

FIG. 307. A GREENHEART RAFT

After the timbers are cut and squared by hand they are built into a large raft buoyed up by lighter timbers and transported down the tidal rivers to the ports; an entire family may live in the thatched hut on the raft, for days drifting with the slow current.

commodities of little importance in Demerara and in addition a few in common.

Essentially similar to British Guiana, with an alluvial belt, forested hills and mountains, and interior savannas, Dutch Guiana has evolved a somewhat dissimilar utilization of the land as a result of differences not only in physiographic characteristics but also in climate, transportation facilities, and population. Most of the agricultural activity centers about the production of sugar, coffee, and cacao, which occupy the larger share of the 62,000 acres cultivated. *Balata* constitutes the only important commodity obtained from the forests, and gold the only one from the mineral resources.

Agriculture has always predominated in Dutch Guianan activity. From the very earliest days of European occupation, reclamation or

diking of the fertile coastal and river-valley lands has been developed. Sugar, cotton, cacao, and coffee early became of importance. At the close of the eighteenth century 60,000 laborers worked on 665 estates. Soon, however, decadence set in for several reasons. The colony,

FIG. 308. AN INDIAN BARBER IN THE INTERIOR

Dutch Guiana, like the adjacent colonies, is greatly handicapped by backward Indian and Bush negro folk sparsely inhabiting much of the territory.

which had been quite willingly accepted by Holland in exchange for New Amsterdam (now metropolis of the New World) in the seventeenth century, suffered a commercial eclipse. The commerce, which had amounted to almost $10,000,000 in value at the opening of the nineteenth century, declined steadily; even now total

trade hardly approaches the export value of the former commerce. Funds became scarce, slaves secured emancipation, competition by American cotton ruined the native industry, beet sugar (encouraged by bounties) proved destructive to the sugar trade, gold discoveries deterred capital and labor from settling on the land, and in the meantime Paramaribo had been twice devastated by fire and once ravaged by yellow fever. In 1873 estates numbered 123, working an area of 25,000 acres; in 1903 there were 82 estates, with the same acreage. Since 1903 a gradual rise in the area of cultivated land has increased the total to the present 62,000 acres.

Agricultural Products.—Sugar, on a smaller scale, receives much the same consideration as in British Guiana. It forms the principal export commodity of the colony, and in 1924 four estates, which account for almost all the crop, produced 9,000 tons. The sugar industry, aside from labor shortage, is handicapped in that the cane, in common with other crops, as a result of the unattractive climate, tempered somewhat by trade winds, is especially susceptible to diseases. Whereas in British Guiana the estates are close to or at the sea, thereby receiving the cleansing effects of the breezes, in the Dutch colony, where the land is slightly higher at the coast, the plantations lie at some distance from the sea. In the latter lands the hot and humid atmosphere, relatively undisturbed by winds, proves very conducive to the spread of disease.

Among less important crops, coffee ranks second to sugar. In the eighteenth century it was one of the leading products of the colony, its exports annually exceeding 12,000,000 pounds. Lack of labor, following the abolition of slavery, brought about a general decline which persisted until the destruction of cacao plantations by the witches'-broom disease. Then growers turned to Liberian coffee and initiated the recent rise in importance of the crop. Today, nearly every estate yields some coffee, either as a principal crop or as a secondary product and production totals some 6,000,000 pounds. Cacao, which at one time was a leading crop, now produces a negligible amount of revenue. The dreaded witches'-broom disease has sounded the virtual death knell of the industry and in recent years it has shown an uninterrupted and rapid decrease in output. In addition, quantities of rice, cotton, coconuts, various vegetables, corn, and fruits contribute to agricultural production.

Forest Products.—From the vast forest of the country, native inhabitants secure a few commodities for exchange. *Balata* has long been the leading product of the forest, and one of the principal exports of the country; in 1924 more than 2,500 laborers produced 555 tons. The industry displays remarkable strength in view of the ruthless methods of exploitation, which persist despite the efforts to supervise the forest workings. Timber resources are tremendous, but in common with the conditions in most of tropical South America transportation offers definite handicaps. The numerous falls and rapids, the fluctuating stream levels, the high specific gravity of the valuable hard woods, the lack of homogeneity in stands, and the scarcity of labor prevent any significant utilization of the major forest wealth.

Mineral Products.—Since its discovery in paying quantities in 1876, gold has been an important product of Dutch Guiana. The leading gold workings are almost entirely placers. Difficulties of transportation and exhaustion of richer deposits have caused a steady decrease in output, so that today only a few thousand ounces are obtained. Recent developments in bauxite, in contrast, have tended to compensate for the decreases in gold. Directly accessible to ocean-going steamers, the bauxite mines lie about 100 miles east and south of Paramaribo. Production averages close to one-half British Guianan figures.

FRENCH GUIANA

As the smallest, most sparsely populated, and least developed of the Guianas, French Guiana offers little inducement for economic expansion. Retaining the general physical characteristics of the other colonial lands, French Guiana suffers from even more difficult means of transportation; the Maroni presents the problem of more than 300 waterfalls and rapids to be crossed by the traveler. Moreover, labor is much more scanty; agriculture languishes in a country which has a population less dense than that of any other South American country; in comparison with Brazil's low figure of more than 9 people per square mile and Paraguay's 6, French Guiana has no more than one and three-tenths, a fact directly mirrored in the lack of development in the colony.

Among the basic handicaps to progress, difficulties of transportation, labor, and poor management of enterprises have played prominent parts. Penetration to sections of the interior demands almost

impossible feats; Bush negroes carry on the only interior up-river traffic. Fifty miles comprise the maximum distance for steamers up the rivers, although the Maroni proves suitable for canoes for some 300 miles. Artificial means of communication consist of three principal highways of restricted length, maintained chiefly by convict labor, and of 7 miles of railway serving principally the penal establishment, the derogatory influence of which has proved no small deterrent to the progress of French Guiana. Formerly, to have been sent to the prison of the colony meant but one prospect to the French criminal—death from one of the numerous tropical maladies, most of which have now been eradicated as frequent menaces.

The freeing of slaves in French Guiana in 1848 caused a labor crisis which has persisted in varying intensity to the present and bids fair to continue indefinitely if the colony attempts to attain real progress. Although various sources have been tapped, importation of labor has proved of little avail. The Bush negro, with his superb physique, prefers life in the forests and on the rivers; descendants of freed negroes display marked apathy toward labor on the land; those Portuguese, Chinese, and Japanese who remain turn usually to trading; and other peoples arrive only after the greatest persuasion and always in small numbers. Under such conditions the almost somnolent state of agriculture requires little comment.

Of the Guianas, the French colony displays a noteworthy lack of agricultural activity. Some 8,000 or 9,000 acres produce small quantities of crops like those of Demerara and Surinam, but destined almost wholly to domestic consumption; agricultural commodities in value make up less than one-fourth of one per cent of total exports. The most important export is gold, which accounts for half or more of the value of shipments from Cayenne. Production is largely on a small scale in scattered fields, but output is more than twice as great as those of British and Dutch Guiana combined. The forests yield the second industry, based chiefly on rosewood essence and *balata*, the two products in some years exceeding gold exports in value.

THE GUIANAN OUTLOOK

Despite their exceedingly rich resources, the three Guianas offer few indications of a noteworthy enhancement in status. Each colony has fertile alluvial soils, magnificent forests, comparatively valuable

savannas, and extensive mineral deposits, but each has also serious handicaps of transportation, climate, labor, and capital (Fig. 309). While British Guiana probably always will surpass the Dutch and French colonies in opportunities for economic development, even in

Fig. 309. Sugar for Export, Georgetown

its case marked progress seems long distant, for its principal agricultural product evinces no ability to compete successfully with that of more favored lands, and marked industrial advance is out of the question.

The key to future progress in the Guianas lies in two fields: for the exploitation of the forests, efficient means of transportation are vital; to populate the agricultural and pastoral lands and provide labor for the forest industries, an increase in population by immigration is imperative. Until the time when such development becomes possible, the colonies will follow present trends. Inasmuch as neither capital nor population manifests much interest in transportation or immigration, these tendencies are bound to display marked persistence.

CHAPTER XLVIII

TRINIDAD

Although but a small satellite of the South American continent, Trinidad surpasses any other political unit in South America in point of the ratio of productivity to area. In all, the island comprises an area of 1,862 square miles, yet in the period 1925–1928 its average annual commerce, exclusive of transshipments, totalled nearly $50,000,000. The combined sum of Ecuadorian and Paraguayan foreign trade does not attain this noteworthy figure, though they embrace far greater areas and have a combined population almost 10 times as great. The island has richly rewarded the efforts of its British rulers to develop its manifold resources. Together with its dependency—Tobago—it produces more wealth per inhabitant than any other portion of the British West Indies.

Though on discovering the island in 1498, Columbus made exceedingly favorable reports, Trinidad experienced no material progress for centuries. Strife among the several European nations contending for positions about South America, as well as the depredations of numerous pirates, strangled possible advance. Indeed, an actual decrease in population had set in during the eighteenth century despite the richness of the land. Not until the nineteenth century, following its cession to England by Spain in 1802, did the island secure the opportunity for peaceful development. Practically the sole product in these early days was a negligible quantity of cacao produced by African slaves, the Indian slaves having been almost exterminated. Under British rule, agriculture expanded rapidly, only to be checked by the emancipation of slaves in 1834. The situation resulting was remedied by the importation of immigrants, chiefly East Indian coolies, but also many Chinese and West Indians, so that today Trinidad has a notably varied population.

Compared to other islands of the West Indies, Trinidad has a light density of population; shortage of labor is chronic. Large areas still remain available for development, for the total population of some

380,000 peoples the land only to the extent of 200 persons per square mile. In Barbados, for example, the figure rises to 940 persons. Moreover, one-sixth of the 380,000 persons live in Port of Spain, the one large city and port of the colony. By far the majority of the population lives in the western parts of the island, within two princi-

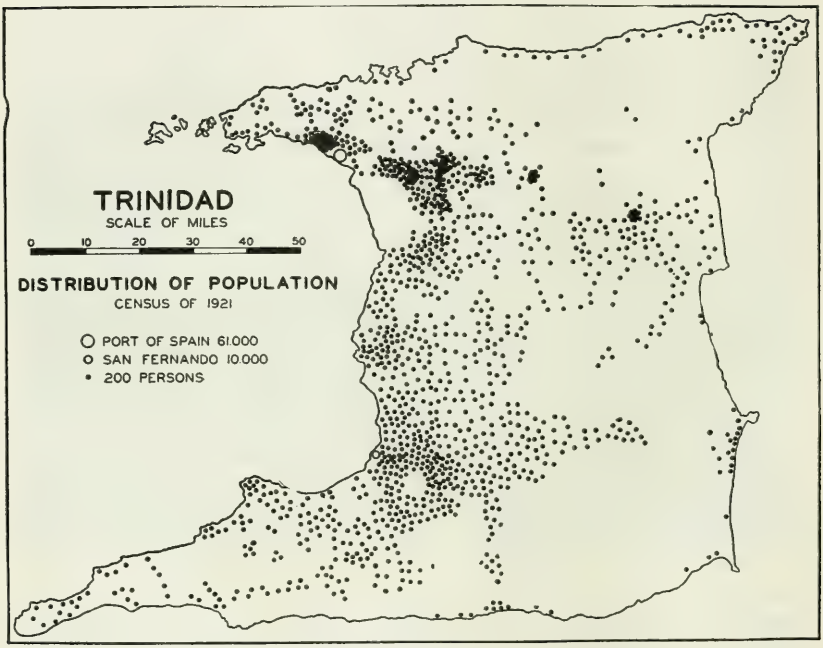

Fig. 310. Distribution of Population in Trinidad

Compare the distribution of population with the relief, rainfall, and land utilization maps.

pal districts—one adjacent to Port of Spain, the other in the southeastern corner of the Gulf of Paria about San Fernando, a town of 10,000 and second to the northern settlement in importance (Fig. 310). The first district depends upon the city and its influence and the near-by productive zones of cacao and sugar; the second serves the sugar lands of the south and the important oil and asphalt area.

The heterogeneity of population is unusual. In a short stroll in the business section of Port of Spain may be seen a multitude of races, from turbaned East Indian to urbane Englishman, including appreciable elements of French, Spanish, Chinese, and negro strains; among

the group, also, are many Venezuelans, political exiles. The East Indians compose more than one-third of the island's population and constitute the most important source of labor for the sugar lands along the west coast. They have also introduced the culture of rice, an industry now of considerable size. The largest element, the negro, furnishes labor on the cacao estates and in the oil districts, where he withstands the rigorous demands of his task better than the less sturdy coolie.

The smallness of the island has favored the development of many sections. Railroads serve the leading agricultural districts and the possession of the famous Pitch Lake results in Trinidad having an exceptionally modern road system. Coastwise traffic, centered chiefly at Port of Spain, is brisk, especially on the west. The east coast has practically no large shipping points because of the small open harbors exposed to the waves and winds of the sea. External communications also benefit the island to a great degree; most of the food consumed in the capital comes from the outside. Trade with the Orinoco lands in particular, the neighboring coasts of northern Venezuela, and the near-by islands of the West Indies attains large proportions. A Venezuelan of Caracas wishing to visit Ciudad Bolívar or San Fernando de Apure on the Orinoco, takes a line-steamer to Port of Spain and transfers to an Orinoco River steamer. Moreover, the quickened interest in the island induced by oil developments, in addition to its agricultural significance, makes it a regular port of call for some of the principal steamship lines operating between South America and the United States or Europe. While Port of Spain has no deep natural harbor, the protection afforded by the northern mountain range and the mountainous Paria Peninsula of Venezuela make the open roadstead on the placid waters of the Gulf of Paria quite safe.

Trinidad consists essentially of three east-west systems of hilly to mountainous land, separated by two belts of low to moderate relief. The north portion of the island consists of the northern range, a rugged, deeply notched range of mountains rising to 3,000 feet (Fig. 311). A lower range forms the southern limit, while across the middle extends a third parallel belt of rough land. To the north and south of the central range lie the flat lands and swamps and the dissected plains and slopes on which the major agricultural development has taken place. The sugar lands occupy the rich black loams of the west,

the cacao estates the yellow to red clays of the more protected interior, the rice paddies the heavy black drained soils of the Caroni Swamp near Port of Spain, and the coconut groves the well-drained sandy soils of the southern and eastern coasts.

In conjunction with the favorable soils, climatic conditions make

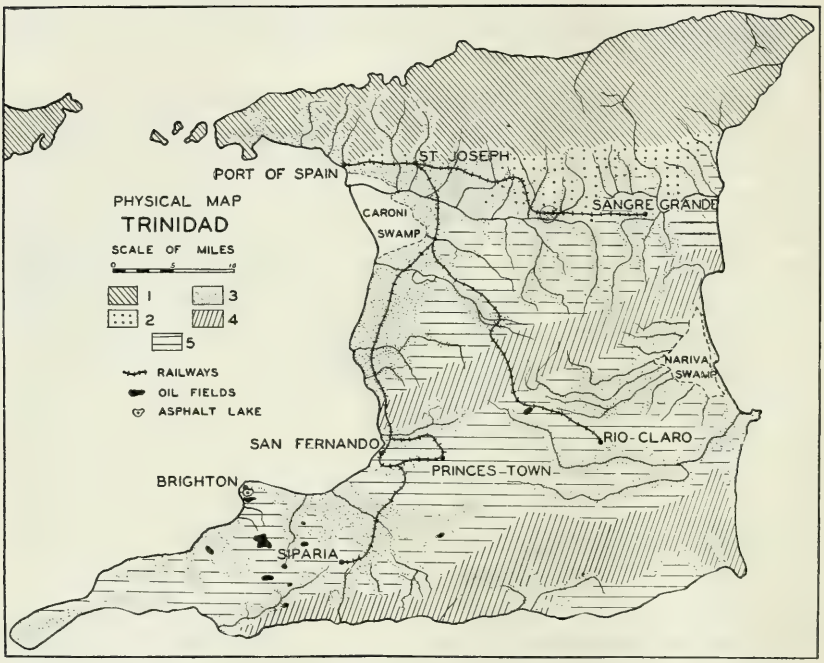

FIG. 311

In the physical map of Trinidad the two great lowland areas stand out strikingly between the north, central, and southern highlands respectively: (1) north mountains—old rocks, (2) sandy flat plains, (3) recent alluvial lands and swamps, (4) central and southern highland—regions of moderate relief, (5) rolling to hilly dissected plain, clay and sandy soil areas.

for almost ideal agricultural adaptability of the land to the principal crops. Rainfall ranges from somewhat less than 60 inches per year in the west to more than 140 inches on the eastern heights of the Northern Range (Fig. 312). Most of the cultivated land receives between 55 and 90 inches per year. Though no month of the year passes without rain, a distinctly rainier season embraces June to December inclusive. As typical of its equatorial location, the island receives its precipitation in the form of heavy convectional showers,

usually accompanied by lightning and thunder and followed by brilliant scorching sunshine. Since the island reaches no great heights, temperatures are comparatively uniform and characteristically marine equatorial, the warmest month—May—having a mean temperature of 78.8° F, the coolest month—January—one of 75.6° F.

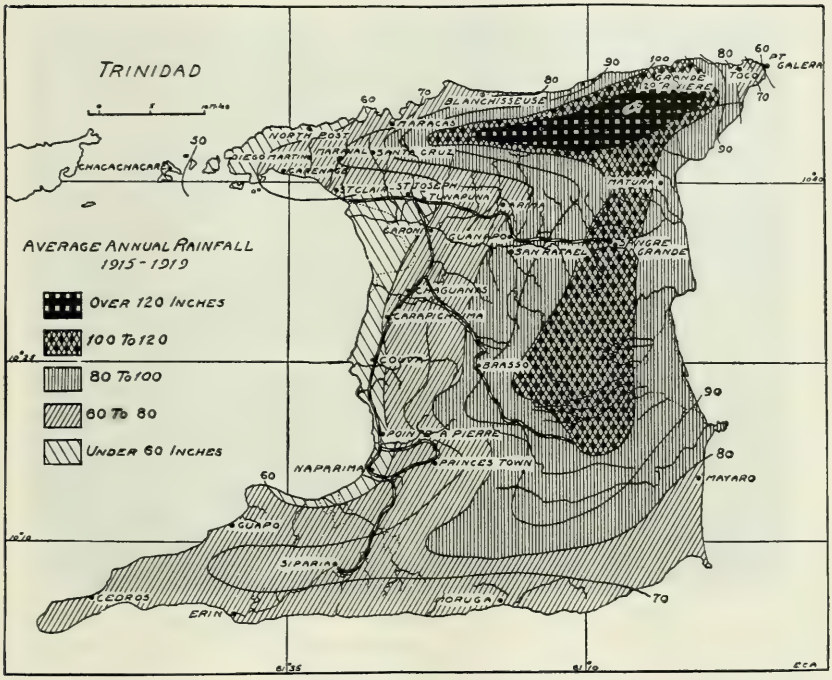

Fig. 312. Rainfall Map of Trinidad

(From "A Geographic Reconnaissance of Trinidad," Preston E. James, *Economic Geography*, Vol. III (1927), pp. 87–109; courtesy of P. E. James and *Economic Geography*.)

The high relative humidity of the atmosphere is especially beneficial to cacao, but also notably enervating to man; malaria still constitutes a dreaded menace in many districts. Of great advantage to Trinidad is its location off the path of the hurricanes which periodically devastate parts of the West Indies, for thereby the cacao industry on a large scale becomes possible. Nevertheless, the estates must locate far inland or behind an effective windbreak to secure protection against the desiccating effects of the strong easterly trade winds.

Almost two-thirds of Trinidad remains unutilized for agriculture

and most of this area supports a dense tropical rain forest of exuberant luxuriance. From the original forest come numerous timbers and a small output of rubber, and in the shade of the taller trees lie the many cacao estates. Elements of the flora of both the Antilles and the South American mainland may be found here. The coconut palm

FIG. 313. A VIEW IN A TROPICAL RAIN FOREST, TRINIDAD

Though tropical rain forests cover considerable areas in the highlands of Trinidad, they yield little in the way of timber products; boards 12 feet long, 10 to 18 inches wide, and 1 inch thick, cut and sawed by hand at a cost of 30¢ per board, are headed to the roads for 24¢ per board per mile and hauled by truck to Port of Spain for 7¢ per board; this increases the cost of native timbers to a point where they can not compete with imported lumber.

is a conspicuous member of the coastal forests, but it belongs to the exotic forms. Most of the forest areas are in forest reserves, areas set aside by the Colonial Government as permanent timbered lands to protect the hilly and mountain lands from rapid erosion under the heavy precipitation and to protect fertile valleys from inundation and destruction by deposition of huge quantities of gravel. Some forests occupy infertile soil areas on the lowlands and strips to protect the cacao groves from the drying effect of the persistent trades. Though the forests contain scattered members of valuable species, no

great lumber industry has developed, owing chiefly to the expense of obtaining the materials (Fig. 313). Savannas utilized to a small extent for grazing break the forest domain in several parts of the island; they occur in areas of sandy or gravelly soils, from 2 to 4 feet deep, below which is a heavy impervious white clay.

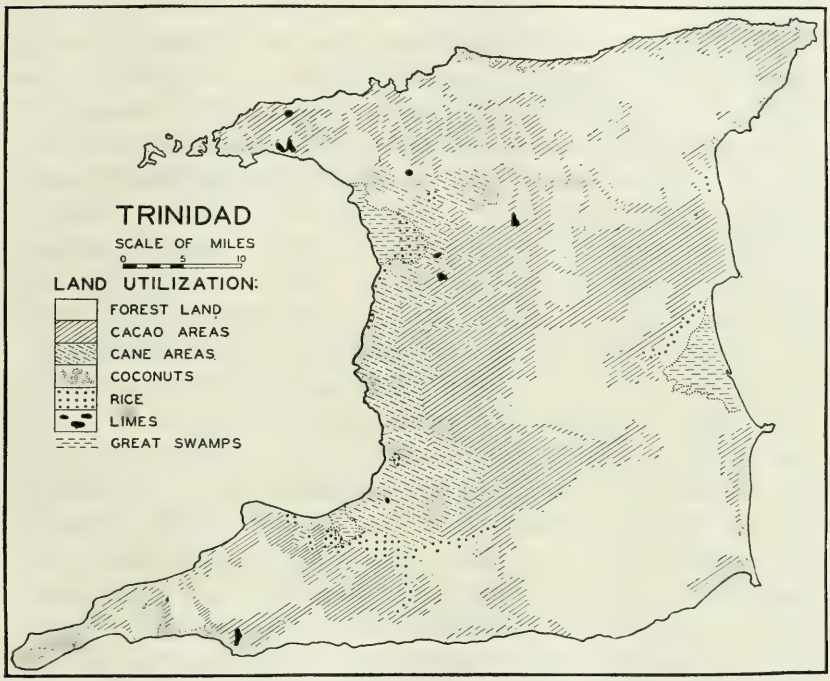

Fig. 314. The Utilization of Land

UTILIZATION OF RESOURCES

The agriculture of Trinidad has developed several well-defined regions. On the west coast, from Port of Spain to a point south of San Fernando, extends the sugar-producing district. Bordering the interior limit of these lands, lie the zones of cacao production (Fig. 314). Coconuts come from three widely separated sections: the northeastern, southeastern, and southwestern coasts. The inner portion of the Caroni Swamp is a great rice field. Except for the free forest dweller most of the northern mountain country and the lands of the southeast have little activity.

Besides the agricultural districts, the zone of oil-producing lands

about the Pitch Lake forms a distinct division of Trinidad's territory; and the southwestern ends and islands of the northern mountains constitute a resort and playground for the well-to-do.

The Cacao Industry.—The production of cacao since colonial days has engaged considerable attention in Trinidad and it has always held a prominent position among the agricultural industries. Today, Trinidad stands second among South American producers of cacao, having recently surpassed Ecuadorian output in consequence of the effects of the witches'-broom disease on the latter. The crop occupies 200,000 acres, or about one-sixth of the island's area. The combined acreage of all other crops totals scarcely more than half that in cacao.

Physical conditions favor production of the bean. Moisture supplies are excellent, annual rainfall of 70 to 100 inches or more proving sufficient at all times; a high relative humidity prevails throughout the year. Though strong winds occur near the coasts, windbreaks provide the necessary protection. Optimum conditions are realized in the deep valleys of the ranges where hardly a leaf stirs in the damp dark forest. Soils do not reach the ideal, but they are of good quality and fairly well drained, and are constantly replenished by the wash of soil materials from the mountain regions. For shading the trees, the *bois immortelle* (*Erythrina umbrosa*) provides all necessary requirements. Five districts stand out in cacao acreage and production: (1) a series of flat-floored deep valleys of fresh soil material on the southern flank of the northern mountains north of Port of Spain; steeped in humidity and well protected from the northern winds, these alluvial valleys constitute one of the most productive cacao areas of the island; (2) the narrow and steep-sided valleys of the central range and the dissected plain north of it in the Montserratt district; heavy precipitation, high humidity, freedom from winds, good drainage and clay fertile soils aid in creating the richest cacao community of the island; (3) the Sangre Grande district, valleys of heavy yellow clay soils and protected from the northeast trades by a forest belt along the eastern coast; (4) the valleys of the southern mountains and dissected plains near the south central and southwestern part of the island; and (5) the deep humid valleys of the northeastern part of the island, a minor district of the small proprietor (Fig. 315).

For man these interior lands are less attractive. The problem of a

sufficient labor force often becomes acute, for the region most suitable for cacao also is highly favorable to the malarial mosquito. Although small holdings yield much of the crop, the extensive estate prevails in certain districts. The laborers live in villages clustered about the dwellings of the overseers and the sheds used in preparing the beans

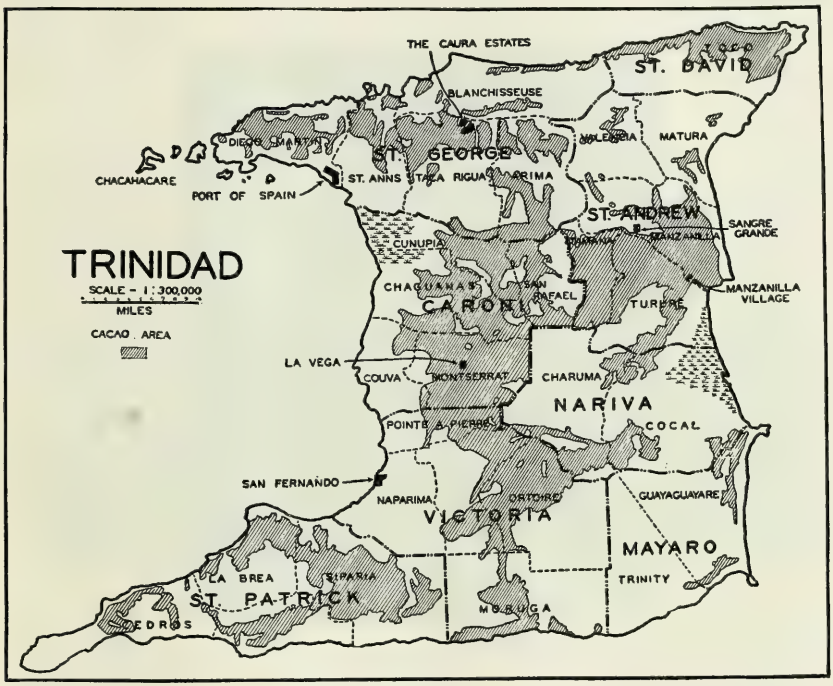

Fig. 315. The Cacao Districts of Trinidad

(From "Economic Survey of the Cacao Industry of Trinidad, British West Indies," C. Y. Shepard, *Economic Geography*, Vol. III (1927), pp. 239–258; courtesy of C. Y. Shepard and *Economic Geography*.)

for shipment. Between the two harvests each year, little activity occurs on the cacao lands, the trees generally receiving scant attention, though in recent years more cultivation and clearing of trees rule. The harvest season, in contrast, is a busy one, for the preparation of the bean for marketing must be done with dispatch. In comparison with sugar cane, cacao production requires relatively little capital, hence the large number of small plantations.

Trinidad cacao has superior quality and commands good prices in world markets. The United States takes most of the export each

year. The witches'-broom disease which has appeared may cause a sharp drop in output, but governmental agencies are exerting every available means to prevent the spread of the infestation, as yet confined to only a few hundred acres. New outbreaks, however, are reported constantly and an alarming situation may develop. The uniformly high relative humidity of the cacao forest, so favorable to

Fig. 316. In a Cacao Grove

Though several parts of Trinidad possess almost ideal physical conditions for cacao, a number of insect pests and diseases do considerable damage; witches'-broom disease is present in several areas in the eastern part of the island; black pod rot, which has attacked the pod being held by the man, does considerable damage.

the tree, is also extremely conducive to the spread of the disease (Fig. 316). As in many other sections of South America, diversification must increase in order to avoid the dangers attendant upon overspecialization in one crop and maladjustments in some districts. The cacao situation is generally a sure indication of general economic conditions in Trinidad. Already the trend to a better balance has begun by cutting out the trees in those districts less suited to the crop.

Sugar.—For many years following British occupation of the island, sugar was the leading product of Trinidad. Planting spread in many parts, on fine soil as well as on poor; but with the emancipation of

slaves first, and later with the growing competition of beet-sugar and foreign cane-sugars in the principal markets, the industry partially gave way to cacao. Today it holds some 35,000 acres of the flat to rolling plains in the western part of the island in a broad belt south of the northern range to south of San Fernando (Fig. 317).

The many crises through which the industry has passed have led to the localization of sugar-cane cultivation on lands of the most suitable type. Therefore, the less rainy, sunnier west has become an extensive

Fig. 317. In the Chief Sugar District

On the low flat alluvial plains in the western part of the island soils, precipitation, and temperatures are almost ideal for sugar cane; in the distance rise the mountains of the northern highlands.

sea of light green, almost devoid of interruption by other cultivations. The eastern border of the district lies a little to the east of the 75-inch annual rainfall line. Here has developed the greatest agglomeration of population, for the cane-fields demand abundant labor, in Trinidad supplied chiefly by the East Indian, who lives in buildings of wood set up by the company or in rude huts of mud or thatch. Almost one-half of the crop is produced by small-scale renters who grow the cane and sell it to the large operators. The sugar centrals are few in number but large, one near San Fernando accounting for one-third of the annual output of sugar and by-products. Railroads constructed by these companies extend to all parts of the region and have ready access to Port of Spain. As a whole, the sugar industry enjoys a posi-

tion more stable than that of cacao; paucity of labor is the principal handicap to marked expansion.

Coconuts.—This characteristic industry of a rich tropical isle has had a rapid growth in the twentieth century, until today it ranks second in acreage among cultivated crops with some 41,000 acres. Its beginnings were entirely accidental, for the tree was not indigenous to the island, the famous natural plantation of the *Cocal* of the east coast apparently having secured a start from nuts drifting ashore from a shipwreck.

The graceful trees occupy the well-drained sandy soils of the coast,

Fig. 318. An East Indian Hut

In the three major swamp regions of Trinidad rice becomes the chief crop; it is cared for chiefly by East Indians; back of the hut are rice patches; on the left is a patch of corn and cassava mixed.

where winds, rains, soils, and lack of labor supplies preclude production of cacao or sugar. Proximity to the sea permits the industry to flourish in more remote parts of the island, whence the small population can easily ship its product of whole nuts or copra to Port of Spain for reshipment. The outstanding district is that of Cedros, which clothes the tip of Trinidad's southwestern promontory with myriad coconut palms; the Nariva-Mayaro district stretches along the east coast; and the north shore district fringes the coast back of which rise the spurs of the northern range. Though wide fluctuation in prices for nuts and by-products occur frequently, the industry has a secure foothold and is becoming more deeply intrenched because of the growing use of its products in various manufactures.

Because of the excessive interest in its major crops, Trinidad must import many provisions. Nevertheless, domestic production yields many foodstuffs. Rice, the staple food of the East Indian element, grows on some 8,000 acres (Fig. 318); mixed cultures—embracing a diversity of crops such as corn, cassava, bananas, yams, breadfruit, and numerous less useful fruits like limes, oranges, lemons, and grapefruit—occupy 12,000 acres. A new crop—coffee—has taken over

FIG. 319. ZEBU CATTLE

These animals, big and strong and well adapted to heavy transportation, provide very low-grade meats; Trinidad has little in the way of an animal industry since meats can be imported from the Llanos of Venezuela cheaper than they can be produced in the island.

1,400 acres in recent years, but the oil industry has robbed it of a possible labor supply.

Except for a few animals raised for draft purposes, grazing in Trinidad is negligible. This is due chiefly to the ease of importing cattle from the Venezuelan llanos and the poor quality of the grasses on savanna areas. Native breeds contain considerable zebu blood, because of relative zebu immunity to Texas fever (Fig. 319). To control ticks spraying or dipping is necessary once a month, but many farmers do not adhere to spraying rules.

The Asphalt and Petroleum Industries.—While cacao is the agricultural mainstay of Trinidad and concerns the largest number of people, the island derives its principal sources of revenue from the asphalt

and petroleum industries. In many years only the taxes obtained from these products have maintained the financial positions of the land. Moreover, the steamship connections dependent upon asphalt and oil, as well as the world-wide interest in these commodities, lend especial importance to their significance to Trinidad. On the other hand, however, discoveries of oil in particular lead to disturbed agricultural conditions, owing to the high wages paid in the oil-fields and to the attractiveness of the neat rows of houses in communities made

FIG. 320. HEADING ASPHALT TO SMALL RAILWAY CARS

West Indian negroes inured to hard labor do much of the heavy and disagreeable work in digging and transporting the asphalt.

healthful by the operating companies. Practically all of the activity is carried on in the vicinity of the Pitch Lake near the southeastern shores of the Gulf of Paria, although much of Trinidad south of the central range has oil indications and two fields east of the Brighton district have been opened.

In a lake of some 115 acres, Trinidad has the world's chief source of natural asphalt. So excellent is the product and so readily produced that it composes a large part of the world's output of asphalt, despite the rapid increase in the manufacture of petroleum asphalt. The deposit lies at the surface about one mile from the sea; ships can readily load by tying up at the pier extending into the quiet waters of

the Gulf for one-third mile. After going through the refinery built near the lake, the asphalt reaches the hold of the vessel by way of an aërial cable.

At the present rate of production, the lake has an estimated reserve for 400 years, so that Trinidad will long derive considerable revenue from its exports of pitch (Fig. 320).

The petroleum field which feeds the asphalt lake now produces more value than any other single industry of Trinidad; and with a 1928 production of more than 7,600,000 barrels, the island is the largest oil-producing unit of the British Empire. Developments have made rapid strides in recent years. Fourteen companies are actively engaged in operations; oil derricks are springing up in many districts. Almost one-half the output goes by pipe-line to a point near San Fernando for refining; the remainder is shipped crude.

THE FUTURE

The immediate prospect for Trinidad depends to a large extent on the witches'-broom and other diseases. Should the troublesome fungus affect Trinidad estates as it has those of Ecuador, troubled waters lie ahead. The large investment of capital in the plantations and the size of the labor force prevent any abrupt shift to other crops. Furthermore, conditions of climate, soils, and transportation and marketing problems do not permit much planting of sugar or coconuts. The situation is further aggravated by the oil-field operations, for with decreased cacao production and subsequent lower wages labor will flock to work in the new districts; an eventuality which may well be dreaded, as indicated by the grievous situation of Venezuelan agriculture resulting from the boom in the Lake Maracaibo oil fields. Petroleum may rise greatly in value of exports, but it will not permanently affect the island as a whole. But regardless of reverses of one kind or another the island with its favorable natural conditions and large population will continue as one of the more important British West Indies and a significant way-station to South American points.

CHAPTER XLIX

THE DUTCH WEST INDIES[1]

Like many other islands of exceptional strategic importance, the Dutch West Indies, Curaçao especially, display certain great contrasts. On one hand, these three islands have a combined area of 374 square miles, but they fall far short of supplying the food needs of their 50,000 people. This is particularly evident in Curaçao, which comprises 210 square miles and has 35,000 of the aggregate population. On the other hand, Curaçao is one of the principal ports of Caribbean America, a port of call and fueling station for several steamship lines; and for western Venezuela it holds a place strongly resembling that of Port of Spain for eastern Venezuela. As a refuge for political exiles and as a revolutionary base Curaçao has figured in Venezuelan politics since the Wars of Independence. Most of this significance is the result of one major and local natural advantage, the harbor at Willemstad, and of a position near the entrance to Lake Maracaibo (Fig. 321).

The deep harbor upon which fare Willemstad and its two small neighbors—Otrabanda and Scharlo—is one of the finest in the Caribbean Sea. The entrance to the harbor is about 400 yards wide and crossed by a queer pontoon bridge, pushed aside by a small engine to allow ships to enter. The harbor has a natural depth of 80 feet and widens out into a bay, large and deep enough to accommodate the largest navy in the world. The low hills on either side of the bay protect the ships on the lee side of the island.

Owing to the shortcomings of harbors of the near-by mainland of South America, this is of peculiar significance to Venezuela. Since Maracaibo, the chief port of Venezuela, can accommodate vessels drawing only 12 feet because of the bar at the entrance to Lake Maracaibo, Curaçao has become the entrepôt for a large area in western Venezuela and adjacent Colombia. Two additional factors

[1] This discussion concerns only Curaçao, Aruba, and Bonaire. St. Eustatius, Saba, and the Dutch portion of St. Martin, lying as they do in the Leeward Islands, lie almost totally beyond the sphere of influence of South America.

have strengthened this service, namely (1) excellent storage facilities owing to the calling of several lines, thus attracting commodities like coffee, cacao, and hides besides the petroleum from Maracaibo, which is the basis for Curaçao's chief industry, and (2) a brisk coastal trade manned and supplied by local men and ships.

Such value as a shipping center has permitted population to reach an average density of 133 persons per square mile on a semi-arid unproductive group of islands. Willemstad, the capital, has about one-third of the total population, and presents a striking picture with its

FIG. 321. A HARBOR SCENE, WILLEMSTAD, CURAÇAO

Many ocean liners and sail boats line the shore in the long and excellent harbor; in the distance are the large tanks of the oil refinery which give to Willemstad a prosperous condition.

red tile-roofed white and yellow Dutch houses here occupying a hot trade-wind isle. The population consists of three main groups: Dutch—the officials; Spanish and Portuguese Jews—the merchants; negroes—the laboring element and composing more than four-fifths of the total. A distinctive feature of the negro is his interest and proficiency in navigation, the building of small but trustworthy wooden schooners being a leading industry in the island. These sailors ply back and forth between the various islands and Venezuela with great speed as well as with considerable profit. A rather independent type, they create frequent labor shortages by temporarily emigrating to Cuba for the sugar seasons. Their language is a motley idiom of Spanish, Portuguese, Dutch, and English known as *papiamento.*

Except for the harbor, Curaçao, Bonaire and Aruba possess an uninviting aspect from the standpoint of natural resources (Fig. 322). Curaçao, which may serve as a type for the group, is a rather barren, fairly hilly land composed of volcanic rock. In various parts of the central portion of the island dikes of resistant lava rise into low rounded hills—nowhere more than 1,200 feet above the sea. The central portion is surrounded by a rim of coral limestone, generally with an escarpment on the landward side as water falling on the interior enters the porous rock and finds its way to the sea in underground channels. These constitute an important source of water for

Fig. 322. Transporting Water

A burro in Aruba carrying a load of about 300 pounds; over the stone wall to the left note the cactus and the top of the *algarroba* tree. (*Courtesy of George Pratt.*)

the dry island. The surface is stony, the soils generally hard and thin.

Climatic features introduce more disadvantages. Having no great heights, the island fails to receive much rain from the persistent northeasterly trade winds. Moreover, the 22.9 inches of rain which it receives per year loses much of its value in consequence of the rapidity of evaporation on the hot wind-swept surface and of the paucity of moisture from May to October. Temperatures are uniformly high, ranging between 67° F at night to 93° F or a little more in the day.[2] Water supply is one of the most pressing problems on the island. Everywhere cisterns are used to catch rain water and even the condensation of sea water adds to the meagre supplies. For agriculture, irrigation is necessary, the water being obtained from

[2] Reed, W. W., "Climatological Data for the West Indian Islands," *Monthly Weather Review*, Vol. LIV (1926), pp. 133–160.

plantation wells, where windmills pump it from the porous limestone in various parts of the island (Fig. 323).

Under such conditions of soils and climate, natural vegetation can contribute little to the food supply; low scrubby growths and abundant cacti are characteristic, the divi-divi proving of some value as do the spare unnutritious grasses during the rains. It is natural, then, that agriculture has accounted for so little of the islands' importance.

FIG. 323. SELLING WATER IN WILLEMSTAD

One of the chief problems connected with life in the Dutch West Indies is the provision of a supply of water; pumped from underground reservoirs in limestone by tall windmills, water is brought into the city in large or small tanks and sold to the inhabitants at from 2 to 2½¢ per gallon.

Though Curaçao's utility as a point of transshipment is a matter of long standing, its harbor even having served as a rendezvous for early Caribbean buccaneers, its chief importance today depends upon a recent development. For many years, the warehouses of Willemstad took care of large quantities of Venezuelan coffee, cacao, hides, and divi-divi. At present, above all these in strength rises the petroleum refining industry which is based on oil from Lake Maracaibo. Prior to the erection of one of the world's largest oil refineries near Willemstad, Curaçao was already a coaling port. Thereafter, it

added excellent oil-fueling facilities and in addition secured a rapidly expanding export of oil and oil derivations. So great has been the volume of petroleum brought to Curaçao by the shallow Maracaibo tankers, that a huge plant with a daily capacity of 15,000 barrels has already been constructed on Aruba. In 1927, of Venezuela's total exports of 59,000,000 barrels, 48,000,000 barrels went first to Curaçao and Aruba (Fig. 324).

Subordinate semi-manufacturing and manufacturing industries are comparatively unimportant. Imported timbers constitute the

FIG. 324. AN OIL TANKER ENTERING THE HARBOR

One of a fleet of 23 vessels that transport oil from the producing districts along the shores of Lake Maracaibo to the harbor at Willemstad to be transshipped or refined; the significance of Willemstad as a transshipment point grows out of its location near the northern shore of Venezuela and from the fact that vessels drawing more than 11 feet of water can not cross the bar at the entrance of Lake Maracaibo.

basis for the ship-building interests which sell ships in many parts of the West Indies. Curaçao builds practically all of them, Bonaire producing only one or two each year. The rapidity of evaporation favors an extensive salt industry on all three islands. Salt has been from very early times a significant product and export commodity. Fibers from Venezuela and Colombia are used in the manufacture of cheap imitation Panama hats, used by the local populace and exported in considerable quantities. Finally, there are the preparation of a valuable orange peel for the making of Curaçao liqueur in small amounts, the mining of considerable phosphate of lime on Curaçao and Aruba as well as some gold on Aruba, and the export of dried fish from Aruba and Bonaire to Curaçao.

Agriculture, though having the attention of a considerable number

of the people, is in a low state of development and can produce only a part of the local needs. In exceedingly dry years, the crops fail altogether. Irrigation makes possible the cultivation chiefly of vegetables, corn, beans, cassava, a little cane, and some dates; but corn meal and wheat flour are among the most important imports of the people. Most of the land is used for stock-grazing. Goats are the common animals, for they best can crop the meagre vegetation; sheep are next in importance, and there are a few head of cattle and pigs (Fig. 325).

Fig. 325. Typical Hut in the Interior of Curaçao

A low, wind-swept, trade-wind island, Curaçao presents an arid aspect; agriculture without irrigation is impossible; grazing is confined chiefly to goats and a few sheep which with difficulty pick a precarious living from the shrub vegetation.

These tiny outposts of Dutch dominions in South America are bound to hold their significance for many years. Even should their outstanding refining industry collapse, which is unlikely for some time, there still remain the splendid harbor and the proximity to Venezuela. In view of these conditions, Curaçao, Bonaire, and Aruba, despite their deficiency in local resources, have every reason to expect continued activity for years. The improvement and the increase in the size of ocean ships, the constant trouble with the bar at the entrance of Lake Maracaibo, and continued expansion in the Maracaibo Basin increase the position of Curaçao as a transshipment point, the basis of the economic life of the island.

CHAPTER L

PROGRESS

For three and one-half centuries the continent of South America, partly as a result of geographical conditions, racial affinities, and political upheavals, lacked the commercial contacts, the industrial developments, and the scientific movements that have so strikingly altered and directed the course of civilization in Europe and North America. But during the last fifty years no part of the world has shown a greater relative advance than portions of South America. Long isolated and extremely difficult to penetrate, the lands in many portions of the continent are emerging from a simple quiet pastoral life. They are taking on the push, the complexities, and the improvements of this scientific era. A number of factors have aided in this remarkable evolution.

Not until well after the middle of the nineteenth century did political uprisings of one kind or another subside, paving the way for the first steps of progress. Only slowly did the stability of governments make life fairly safe and property reasonably secure, allow the internal accumulation of capital and later attract foreign investments. Following the 1850's Argentina began its phenomenal rise. Bankrupt, disrupted and dazed Peru, and to a smaller extent, Bolivia, took years to show the first signs of recovery from the disastrous War of the Pacific, while Chile, as a result partially of the wealth obtained by the victory, began its great advance. Paraguay, crushed and robbed of its manhood and cattle by the heartbreaking war with Argentina, Brazil, and Uruguay, has not yet completely thrown off the consequences of that struggle. Brazil's great progress has come since the abolition of slavery in 1888 and the establishment of the republic in 1889. Though most of the continent is not free even today from revolutionary outbreaks, serious uprisings have become less frequent and less successful as transportation facilities have been provided and as foreign men and money have entered the continent.

The flood of capital to South America during the last fifty years

has been an impelling force in bringing many sections of the continent into greater productivity. Foreign investments total more than $10,000,000,000, a huge sum, but still inadequate for a complete utilization of the resources of even many small sections. This money has provided transportation for numerous isolated areas, improved shipping and ocean ports, opened up the copper, tin, vanadium, and nitrate mines in the Andean countries, tapped the huge oil pools that have placed South America second in oil production in the world, constructed the great packing plants of Argentina, Brazil, Paraguay, Uruguay, Venezuela, and Colombia, provided public utilities in many of the cities, brought coffee and banana lands into productivity, and established many of the great banking houses of the continent. With the entrance of foreign capital and the establishment of foreign banks, the banking systems of most countries have been studied carefully and placed on a sound financial basis, favoring progress in many lines. Before this capital was forthcoming few sections of the continent made great strides forward.

One of the first large uses of capital in South America provided railway lines and other means of communication, factors of prime importance in the opening up of the continent. In fact, most forms of transportation in South America have thus far owed their chief developments to foreign capital; steamships and railroads in general have returned a steady yield; but highways have not. A striking feature of the economic life of South America until near the close of the nineteenth century was the complete dependence on primitive means of transportation—many sections still struggle under this handicap. Then roads were poor or non-existent; Indians, mestizos or negroes drove their oxen, horses, mules, burros, or llamas before them in Biblical fashion or headed a heavy load themselves over rough mountain trails or through deep forest solitudes. Economy of time did not enter into their simple pastoral or forestal existence. Though these means still exist over vast areas, the continent has made great progress in transportation (Fig. 326). Railway nets cover the Central Plateau of Brazil, the Pampa, and Middle Chile; the Pampa has a network equivalent to that of the state of Indiana. Railroads reach Asunción and Corumbá; others tap most of the mineral and densely populated portions of the Cordillera system. Many shipping lines provide fast and modern services to all the principal ports and

every political division has airplane passenger and mail service. Also, under the pressure of prosperity and the rapid purchase of automobiles, good highways are reaching out from all the chief cities; some cross large plateau and mountain regions and bring enormous areas into great productivity. Yet one of the northern interior states of the United States has more good roads than all South America; but the roads of the United States were poor until recently. On the other hand, rivers are much employed in four regions: the Amazon Valley, with almost 22,000 miles of navigable waterways; the Uruguay-Paraná-Paraguay system; the Magdalena; and the Orinoco. Though these rivers serve vast areas, the traffic they carry is not large. But give South America another half century for transportation improvements (a time equivalent to the greater period the United States has had for peaceful expansion and development than South American republics), and the continent will go far in eliminating many of its handicaps of communication and intercourse.

FIG. 326. BRINGING EGGS TO THE MARKET, BOGOTÁ

While South America has shown remarkable advance in the development of transportation facilities—railway, river, airplane and road—half of the continent still depends upon primitive means of transport; oxen, mules, and even human porters struggle over poor, unkept trails.

In comparison with the great empires settled and developed by North Europeans, the Europeanization of South America has not proceeded very far. Neither in blood nor modern scientific methods does this continent compare with areas opened up by North Europeans. Though many peoples of the world are crowded for space and South America has vast open stretches, there has never been a sudden rush of immigrants to the continent. Throughout all colonial times

increments of Europeans—Spaniards and Portuguese—were relatively small. In the early movement men only came; many with a quickly won fortune returned home. Since independence immigration has pursued a rather leisurely course. Most of the continent still seems unable to attract considerable numbers of immigrants; only in Argentina, Uruguay, east central Brazil and Middle Chile do Europeans

FIG. 327. CLIPPING TABLE GRAPES FOR SHIPMENT

The portions of South America that have registered the great advance during the past half century include those that have been able to attract large numbers of high-class European immigrants; to these same areas the march of immigrants will increase, emphasizing the contrast between them and other areas of the continent; picture taken at Mendoza, Argentina.

constitute a dominant part of the population. In these areas the influx of settlers has been chiefly Italians, Spaniards, Portuguese and Germans. In the state of São Paulo nearly one-third of the entire population is Italian; in São Paulo and Buenos Aires nearly half the inhabitants speak the Italian language, listen to pure Italian music, and brighten the life of the city by the characteristic Italian laughter and song. These people, as a whole, hard-working and ambitious to improve their lot have not been content to remain at the bottom of

the economic and social ladder from which most of them have started. They have acquired wealth and social standing. They have overcome, in part, the caste barrier set up in early days throughout the land between the colonist—the gentleman—and the laboring classes (Fig. 327). On the other hand, this caste still holds to a striking degree in all the tropical portion of the continent and the highland areas of the west and north where Indians and negroes are numerous, and to a smaller extent in the other areas where many Europeans have settled. However, recent arrivals, temporary or permanent, especially Italians, Germans, British and Americans, dominated by industry, commerce, and the desire for financial advance, are exerting a strong influence on the life of the genteel leisure class which has not been in line with major improvements.

While a host of immigrants has not flocked to South America, as to the United States of America, that does not mean that the continent cannot attract them. Far behind the United States in transportation, government and financial policies, education, and sanitation, the flow of immigrants into South American republics may reach the proportions it has in the United States. In 1875 the number of immigrants arriving in the United States totalled only 228,000, or slightly more than the 215,000 who entered Argentina in 1905. Not until 1905 did arrivals in the United States total 1,000,000. In 1928 nearly 500,000 immigrants landed in South America; if by 1950 1,000,000 people come to the continent, South America will have almost equalled the United States, according to rigid calculations. Many conditions point to a larger influx of permanent settlers: progress in caring for immigrants being made in different republics, inducements offered to immigrants, the crowded and unsettled conditions in Europe and the Orient, restrictive immigration policies of the United States of America, the increasing steamship services to South America, and improvements in land transportation, health, sanitation and education.

The recent advance of the continent has been accompanied by improvements in health, sanitation, and education. Through organized campaigns against tropical diseases and insects, veritable pestholes have been made into beautiful healthful places in which to dwell. Most of the coast towns, in the tropical portions formerly fever ridden, no longer have serious epidemics of yellow fever. Mala-

ria and hookworm in several areas have lost their terror. Beggars cured of hookworm or relieved of the ague of malaria have renounced their worthless calling and have placed their shoulders to the wheel of progress. Yet these lands have far to go in these lines. It is still a question whether white man with all his science and medicine can create over large areas of the humid hot lowlands healthful and comfortable places in which to dwell. Also, it is a question whether the Indian, negro, mulatto or lower-class mestizo, steeped in ignorance and almost unable to help himself under the influences of an adverse

FIG. 328. NATIVE HOMES, CARTAGENA

Not much advance can be made by the natives in the tropical lowlands of South America until sanitary conditions have been improved to relieve the inhabitants of the aching ague of malaria or the debilitating effects of intestinal diseases; a filthy pool of water at the doorstep breeding hundreds of mosquitoes.

environment, can with the aid of white man and medicine rid himself of the great toll taken by tropical diseases and insects. With widespread ignorance, disregard of sanitary measures, infestation of 60 to 90 per cent of the population with intestinal diseases, ever-present malaria, high consumption of alcoholic beverages, and a high death rate, human advance in the humid hot lowlands becomes an herculean task. Can the backward, disease-ridden, illiterate Indian, negro, or mestizo advance much in the scale of civilization? If not, will he become an ever-declining factor in the social and economic life of the continent? Or will he, as better conditions of life are created by outside influences of one kind or another, multiply at an amazing rate, consume much of the increased output of the tropical plains, become

a still greater burden for the republics to carry, and remain a large inert mass of unproductive humanity? (Fig. 328.)

LINES OF PROGRESS

Not until after an active demand was created in the north temperate regions for the products South America could supply did the continent awaken from the long centuries of quiescent pastoral and forestal existence. The increasing populations of the countries of Europe and North America, the greater industrialization of the nations, the rise in wealth and the advance in modern scientific methods of all kinds provided the people, capital, shipping, railways, roads, mineral and packing plants, and the demands for foodstuffs and raw industrial materials that gave birth to the latent possibilities of many sections of the continent. Thus temperate plains yield wheat, corn, flax, meats and wool; tropical plateaus produce coffee and cotton; tropical lowlands ship cacao, sugar, bananas, and forest products; the Chilean Desert yields nitrates and copper; the Andean regions increase their output of minerals; some districts pour forth a flood of oil; and other areas advance in a variety of manufacturing industries.

Advance in Agriculture.—Under the Incas, the Chibchas, other native peoples, and later the Spaniards and Portuguese, farming and grazing hardly supplied the people with food and raiment. For nearly four centuries of European occupation, the lands, held in huge estates and tended by an illiterate Indian slave or mestizo class, yielded a few staple crops and supplied inferior meats—on the whole a purely subsistence agriculture. No marked advance was possible until foreign markets created a demand for the surplus production of different regions and until the means of gathering and shipping the fruits of field and range were provided. Most of the progress in South American agriculture has been accomplished during the last sixty years.

Though overshadowed for a long time by mineral exploitation, farming and grazing constitute the chief occupation of the folk of South America. Cattle raising, one of the oldest industries of the continent, has been practiced with care and modern methods only recently and in only a few areas. Only in southeast Brazil, Uruguay and Argentina, have old poor-quality animals been replaced to a

significant extent by high-grade cattle. Only here do modern methods of breeding, herding, and packing produce meats of high quality and in great quantity. This area grazes as many cattle as the United States of America and Canada,[1] truly one of the great cattle areas of the world; yet it stands on the threshold of a greater development. Colombia and Venezuela have 10,000,000 cattle, but the cattle of low grade supply only local meat markets for the most part; these countries and areas in the Central Andes and in central Brazil yield only hides for foreign regions. But given better grades of cattle and modern methods, what can be accomplished in the great savannas of Colombia, Venezuela, Brazil, and Paraguay only can be conjectured. It may be that Brazil with its great savanna areas, with transportation facilities, pure-bred stock and modern methods is destined to become one of the great cattle-raising and packing countries, if not the greatest.

Sheep, less well suited to the tropics than cattle, have been essential for the existence of the highland Indian and have opened up vast vacant areas on the temperate plains of the southeast part of the continent. Though giving way recently to the plow and crops in Uruguay and the Pampa, they find in the arid and bleak stretches of Patagonia a permanent home whence come heavy fleeces of high quality. The output of many areas, grazed to capacity now, may be increased by better breeds of sheep and more scientific methods.

From the standpoint of crop production the southeastern part of the continent has witnessed the great expansion. Favored by level terrain, fertile soil, auspicious climatic conditions, good transport, large immigration and an active foreign demand for the products of the farm, the temperate plains have come to be one of the great granaries of the world (Fig. 329). Yet a small part of the land suitable for the growth of temperate crops has been turned by the plow. In the tropical portion of the continent agricultural expansion has embraced plantation culture of coffee in the rolling plateau of east central Brazil, on the slopes in the deep valleys of the Andes in Colombia and Venezuela, of sugar and cotton in the plateaus and lowlands and of cacao and bananas on the lower slopes and piedmont plains. Here, too, only patches have been employed compared to the

[1] "The World Situation in Cattle and Beef," *Foreign Crops and Markets*, Vol. XIX (Aug. 12, 1929), pp. 250–284, United States Department of Agriculture, Washington.

unutilized land. Everywhere, except in the coffee region of Brazil and in the Pampa, the agricultural work is performed in a crude manner by an Indian, negro or mestizo illiterate class that has little at stake except life itself and enough to eat and drink. Throughout the Andean zone struggling Indians and mestizos farm as they have for centuries and they can advance little, if any, under rigorous climatic conditions and isolated by extremely rugged terrain. But in the southeast part of the continent—in the Pampa and Brazilian plateau

FIG. 329. A HARVESTER-THRESHER IN ARGENTINA

With millions of acres of arable land untilled, the extensive use of labor-saving machinery, and a relatively small consumption, Argentina and other parts of South America stand on the threshold of a period of far greater development. (*Courtesy of Leon Estabrook.*)

—both immigrants and native population express an enthusiasm for material advance; they are surpassing the people of Spain and Italy whence they sprang. In addition several desert districts in different parts of the continent, with increasing irrigation facilities, move forward in a striking manner.

The degree to which agriculture dominates the life of the people is expressed in the proportion of the total exports made up of products of the farm and the range. Nearly three-fourths of the exports consist of farm and range products. In a list of thirteen leading items [2] of export ten are agricultural, and this after nearly 75,000,000 hungry

[2] Clarence F. Jones, "Commerce of South America." Boston, 1928; reference on p. 4.

stomachs have been satisfied; the leading four are coffee, wheat, meats and corn. In spite of agriculture claiming the attention of a major fraction of the population and in supplying the leading exports, only about 5 per cent of the continent is under cultivation. Two countries, Brazil and Argentina, claim nine-tenths of the total. More than half the cultivated land grows four crops, corn, coffee, wheat, and alfalfa; three are subsistence and cash crops while alfalfa is the basis for the cattle industry of the Pampa and irrigated pastures. With such a small per cent of the land in use, the possibilities for expansion, reduced to the lowest terms, are enormous.

Mineral Production.—Though minerals dominated South America commercially for nearly four centuries, the modern advance in mining and mineral production has been no less remarkable than the progress of agriculture. Whereas gold, silver, and diamonds played the leading rôle in earlier days, industrial minerals, nitrates and oil have bolstered up the economic structure of all the Andean countries except Ecuador. Today the output of the precious minerals totals not more than $30,000,000, less than the value of the output of a single great copper camp of Chile. Gold declined because of the exhaustion of the more easily worked placers and the richer veins, and the lack of transportation facilities and equipment for working very low-grade ores. Most of the silver output comes associated with other minerals, and Brazilian diamonds are industrial cutting stones. In the eastern part of the continent agricultural production dominates, but in the western mineral output overshadows, at least commercially, the products of the soil and pasture. Nearly three-fourths of the exports of western South America consist of products of the mines and oil wells (Fig. 330).

A list of the products is striking. The Chilean desert yields all the natural nitrate of the world. Chuquicamata, Teniente, and Potrerillos in Chile, Cerro de Pasco, Morococha and Casapalca in Peru, and Corocoro and Cobrizos in Bolivia produce nearly one-fourth the world's copper. Bolivia concentrates nearly one-fourth the world's tin and the Minasragra mines of Peru yield nearly three-fourths the world's vanadium. Colombia leads in the output of platinum and turns out most of the world's emeralds. Witness the flood of oil: from meagre beginnings only a few years ago, Argentina, Peru, Colombia, and Venezuela swell the output of this valuable com-

modity. Venezuela ranks as the second oil producer in the world, and drills are just beginning to pierce the pools. However, lest overemphasis be placed on the mineral production of the continent, it should be stated that the value of the coal produced by England is several times the value of the total mineral output of South America.

On the other hand, in spite of almost incessant exploitation of the mines of South America for four centuries, vast areas still await scientific exploration and exploitation. In the great Andean recesses,

FIG. 330. IN THE OIL FIELDS OF THE MAGDALENA LOWLANDS

The rapid development of oil in northern South America represents one influence of the great flow of foreign capital and men into the continent to develop its latent resources. (*Courtesy of the Imperial Oil Company, Toronto.*)

where exploration and prospecting are difficult, huge deposits of valuable ores may lie unknown. Great oil pools, in Bolivia, Venezuela, Colombia, and Brazil, fairly well proven, await the time when a decrease in the surplus output of present fields creates sufficient economic pressure to provide transport, labor, and equipment to bring them into productivity. Some of the greatest and richest iron ore deposits of the world lie untouched for want of some of the essentials of manufacturing.

Though holding a dominant place in the production of some commodities and possessing great stores of others, the continent is peculiarly handicapped in the one mineral resource that has played the

leading rôle in the advance of the industrial nations of the northern hemisphere—namely coal. In known reserves it possesses less than any other continent; in fact less than one of the minor coal states of the United States. Coal is found in small fields in most of the republics, but inferior quality, for the most part, thin seams, slaty layers, unfavorable exposures or depths of seams, remoteness and inadequate transportation facilities, restrict the output to less than 3,000,000 tons for the entire continent. This equals 1/500 of the world production; little Belgium produces five times as much as all South America. However, as in the case of other minerals, further exploration and development may increase the figures for the reserves and also the output. Nevertheless, as long as coal remains a significant source of power for transportation and for manufacturing, South America must continue at a disadvantage compared to the more favored regions of the northern hemisphere.

Trade Advance.—Furnishing a primary basis for the developments in mining and agriculture, the demands in the northern hemisphere for the commodities South America could supply have registered a like advance in foreign trade (Fig. 331). Of minor significance a half century ago the exports of the continent now total about $2,000,000,000 and so do the imports. The trade consists in large part of temperate and subtropical products which go to the north temperate regions, and of imports, largely from that zone, which enter the parts of the continent supplying the exports. Intra-continental trade accounts for less than 10 per cent of the total of that of the republics. The United States and the manufacturing regions of northwestern Europe depend greatly on this southern continent for raw materials to supply their manufacturing plants, and for foodstuffs to feed their increasing industrial population. On their side, the people in the South American countries devote their energies chiefly to the production of raw materials rather than of manufactured wares—materials for the most part of comparatively low value for their bulk, the products of farms, ranges, forests, mines and oil pools.

A few products completely dominate each country: Argentina, grains and animal products; Uruguay, animal products; Brazil, coffee, cacao, and animal products; Venezuela, petroleum, coffee, and cacao; Colombia, coffee, and petroleum; Ecuador, cacao, coffee, and *tagua* nuts; Peru, petroleum, cotton, sugar and copper; Bolivia, tin

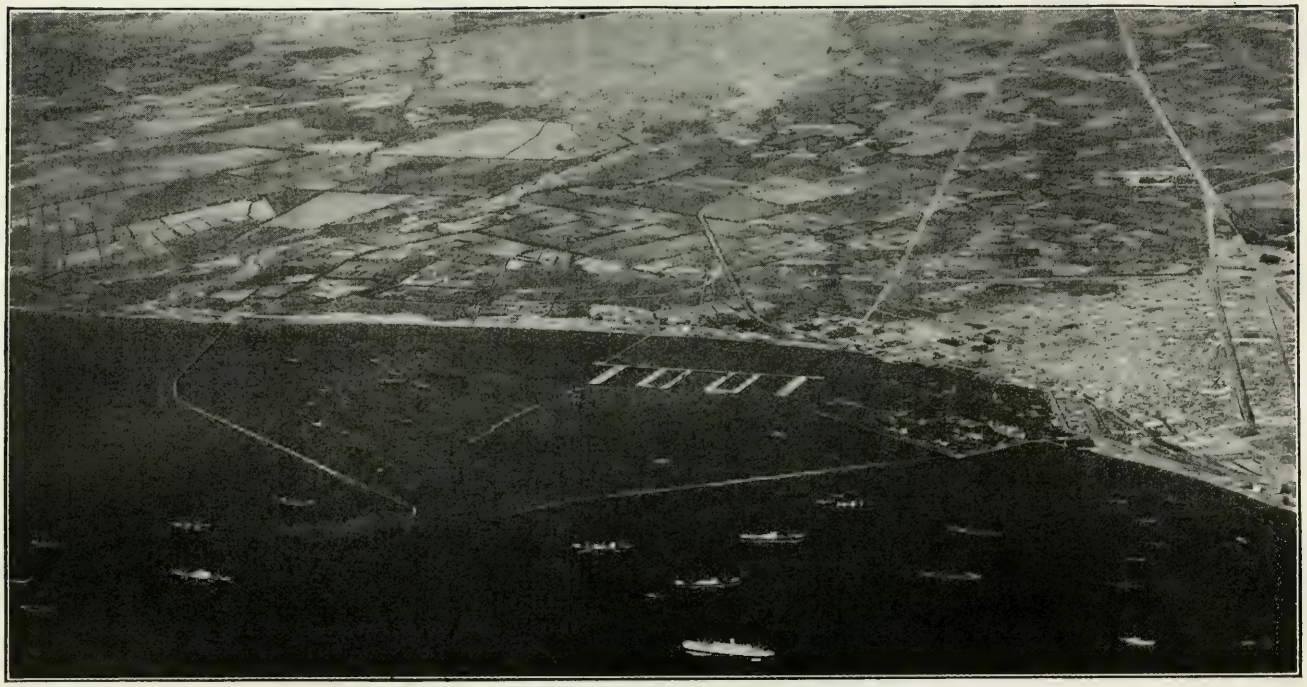

FIG. 331. CALLAO, PERU

The new port development work at Callao, Peru, represents one of the many improvement programs at South American ports to aid foreign shipping; the quilt patch-work of the irrigated farms stretches inland toward Lima on either side of the silvery line of the Rimac. *(Courtesy of the Frederick Snare Corporation.)*

and other minerals; Chile, nitrates and copper. In each case the commodities named comprise from about two-thirds of the total exports to as much as 95 per cent.

Seventy-three per cent of the exports of South America consist of farm and range products; about two-thirds of the total originates in the southeastern part of the continent between 20 and 54 degrees south latitude. The red, rolling, tropical hills of the Brazilian Highlands yield 65 per cent of the world's coffee exports. The monotonous level Pampa of Argentina and Uruguay produces 21 per cent of the export wheat and wheat flour of the world, 72 per cent of the export flaxseed, and 66 per cent of the export corn. The natural and alfalfa pastures of these fertile lands, the semi-arid grasslands of Rio Negro and Chubut and the cool, windy, moist plains of southern Patagonia graze millions of cattle and sheep, which supply 54 per cent, 25 per cent, 23 per cent, and 30 per cent respectively of the world's exports of beef, mutton, wool, hides and skins. The Chilean Desert supplies all the natural sodium nitrate of the world. The Andes yield nearly one-fourth the world's tin, three-fourths of the vanadium, almost one-fourth the copper and most of the emeralds. In four major regions the continent produces an increasing flood of petroleum. No one will question the fact that the possibilities of expansion in many or all of these lines are great. And with increasing purchasing power the imports will mount higher and higher.

A striking and significant fact about the distribution of South American trade is that about 90 per cent of the foreign commerce of the ten republics is with countries outside the continent. The republics themselves are dominated for the most part by agriculture or mining. They are producing raw materials and foodstuffs for the manufacturing regions of Europe and the United States, and for that reason they buy to a large extent from those areas.

The largest intra-continental trade moves between Argentina and Uruguay on the one hand and Brazil and Paraguay on the other. Owing to its inland position, 81 per cent of the exports of Paraguay go to other South American countries (in part for reshipment) and 44 per cent of its imports come from neighboring republics. Peru sends about 20 per cent of its exports to the other west-coast countries, supplying them with tropical products from the irrigated coastal valleys. Intra-continental trade would be greater were it not for the

fact that the northern part of the continent, the truly tropical portion, exchanges products with the United States rather than with the temperate parts of South America. This trade relationship is likely to be maintained for some time, because tropical regions much nearer than the north coast can more advantageously supply the temperate regions with most of the tropical products they need.

Manufacturing.—Though the composition of the imports of South America indicate the small part taken by manufacturing industries in the activities of the different republics, the continent possesses a number of manufacturing regions that show significant advance. They include the Central Plateau of Eastern Brazil, the eastern border cities of the Pampa, the Central Valley of Chile, Coastal Peru, the Medellín and Bogotá districts of Colombia. In all these areas manufacturing enterprises have been restricted to the basic ones necessary to almost every new or pioneer community. They include as the leading industries: cotton textiles, leather, boots and shoes, lumber, furniture, and beverages. Favored by water power, small supplies of inferior coal, the chief concentrations of population in the continent, a variety of raw materials, and *high protective tariffs,* these areas represent considerable industrial developments considered in the light of the southern continents. On the other hand, compared to the great industrial agglomerations of the northern hemisphere, they represent mere specks on a vast continent. All the manufacturing regions of South America have no more people than New York City, and manufacture less in value than the Chicago district. Other than the preceding manufactures, industries consist of the concentration or smelting of ores for shipment and the primary preparation of the products of farm and range (Fig. 332) for distribution to the two great industrial regions of the world—East Central North America and West Central Europe—areas with abundant coal, optimum climatic conditions, stable governments, huge quantities of capital and progressive peoples.

Conditions restricting manufacturing industries in the continent include the sparse population, the character of much of this population, the lack of fuel for manufacturing, the lack of capital for investment in industries, and the opportunities afforded in other fields. Sparsely populated, South America has only 3½ per cent of the

population of the world. Three-fourths of the population (the Indian, the negro, and the mestizo) is of a low order and of a low producing capacity, undesirable for labor in manufacturing industries. South America, as a whole, is deficient in the mineral fuels, and most of the countries have to depend upon importation for their supplies of coal. Moreover, the coals are mainly of poor quality; most of them are semi-bituminous or lignite, and in some cases are high in ash and sulphur

Fig. 332. High-grade Cattle at the Packing Plant, Rosario

The packing industry of Argentina, one of the leading manufacturing industries of the country, like most of the major manufacturing industries of all the continent, is an outgrowth for the most part of the investment of foreign capital for the production of raw materials and foodstuffs to be used in the major manufacturing regions of the world.

content. The coal resources of South America have been inadequately developed, largely because of their inferiority in comparison with foreign coals, and the inaccessibility of the deposits in all the countries, except Chile. Water power for manufacturing is little developed in South America. Although the continent has in its streams 12 per cent of the potential water power of the world, only about one-fifth of 1 per cent of this has been developed.

It is significant that not only manufacturing industries but all other lines of industry in South American republics have been retarded by the lack of capital. The countries have depended upon

foreign capital for the development of their natural resources, the exploitation of the mines, the smelting or concentration of the ores for exportation, the primary preparation of the products of the range for shipment, the building of docks and railways, the construction of the water, sewage, and lighting systems in many large cities, and even the financing of their governments.

Should other mineral deposits of value be discovered and developed, the output in all probability, with the exception of coal, would move to the great industrial regions of the northern hemisphere for manufacture and distribution; today, most all of the production of iron ore, a basic resource in this age of steel, leaves the continent for the Atlantic seaboard of the United States. Though the continent has significant manufacturing establishments, and a variety of resources, it seems that South American manufacturing regions can never compare with those of North America, Europe and Asia. On the other hand, for a new region, resources and economic conditions point to a marked development industrially.

THE OUTLOOK

All things considered, it must be concluded that, while portions of the continent have possibilities for great development, other areas burdened by tremendous handicaps in all probability will not stage any remarkable advance for a long time, if ever.

In spite of the glowing prophecies of a great paradise for white man in the hot, humid lowlands of the tropics and the development of these areas as great producing regions of food and raw industrial materials, the hope of a great tropical granary and storehouse seems little more than fancy. From the standpoint of all the factors that have favored the advance of human settlement during the past centuries [3] the hot humid lowlands of South America do not possess a single one. They do not have favorable climatic conditions, a coal supply, an easily utilizable natural vegetation,[4] any mineral resources, nor an energetic

[3] Griffith Taylor, "Environment and Race," Oxford Univ. Press, London, 1927. References in Part IV, pp. 301–341.

[4] Whereas in North America the forests and grasslands for the most part favored human occupation and development, the tropical hardwood forests and the savannas did not provide auspicious conditions. The temperate forests in addition to supplying very valuable products could be removed with comparative ease. The tropical forest, not so valuable, and growing so rapidly and so luxuriantly, induced an easy-going fatalistic outlook on the people who had to combat it.

population. The enervating heat and humidity, the rapid growth of vegetation, the vast areas of swamp, and a scourge of diseases and insects have precluded rapid settlement in these areas. In fact as white man repeatedly attempts to overcome the handicaps of the tropics, it becomes a grave question as to whether he will ever be able to create over vast areas healthful places in which to live.

In the face of these handicaps and the contacts with white man, the indigenous population is most everywhere on the decline. It seems that the future of this part of South America depends upon a mestizo population or on a different race inured to the hardships of such an environment. At present the whole tropical portions of the continent harbors less than one-third of the total population. The population of the tropical portion consists mainly of Indians, negroes, and mestizos, —a population with a small producing capacity and a smaller purchasing power. Dreaded diseases—malaria, yellow fever, tropical dysentery, and hookworm—prevalent in tropical lowlands, sap the vitality and shorten the lives of the people dwelling there. The people of the hot, moist parts of South America are susceptible to such diseases, except for certain areas in which the negro enjoys almost complete immunity from yellow fever. Where these diseases prevail, economic conditions are stagnant, the victims of the diseases being pale, weak, and unambitious—usually content with a bare subsistence. As laborers they are inefficient.

In addition, the people living in the truly tropical part of South America produce little more than they consume. Why should they? In the hot climate scant clothing suffices; a crude, easily constructed hut furnishes shelter; a few banana trees and a patch of corn, beans, and manioc supply food. Employers of native labor maintain that more work cannot be secured by higher wages, for the laborer on receiving additional money will work fewer days per week. In the opinion of the native, ease is the greatest of luxuries; he does not readily sacrifice this to obtain something less desirable.

That the hot, humid lowlands will become a great storehouse of food and raw materials in the near future is very questionable. The consumption of tropical foodstuffs in the temperate zones of the world is small compared with the consumption of foods produced in those zones. The great importing areas for foodstuffs lie in the north temperate regions, and, while it is true that these areas consume con-

siderable amounts of tropical foods, the main diet of the people consists of the bread, meats, vegetables, and dairy products of the temperate zone. The diet is not likely to be changed materially by the importation of tropical foodstuffs, however favorable the conditions in the tropical part of the world may be for the production of enormous quantities of these articles. The rôle of the tropics in supplying the staple foods of the future will be at most a secondary one. Although the amounts of accessory agricultural commodities from the tropics will increase greatly, the production of breadstuffs, meat, dairy prod-

FIG. 333. THE TRANS-ANDINE TRAIN ENTERING THE TUNNEL

Though bands of steel have bridged the Andean bulks between Argentina and Chile, the influence of the barrier has not been removed completely; commodities that move over the route must stand the cost of transportation; owing to high freight rates, traffic consists chiefly of passengers, high-class freight, and mails.

ucts, and vegetables will continue to be mainly the affair of the temperate lands now supplying them.

Small patches of tropical South America can produce, in so far as the physical environment is concerned, the tropical foods demanded in the temperate zones. Yet this part of the continent has not been called upon to furnish special commodities in great quantities. Central America and various islands of the West Indies—areas nearer to the markets of the United States and northwestern Europe, and having better transportation facilities and more favorable economic conditions, as well as a good labor supply—yield quantities of sugar, bananas, cacao beans, and other tropical products to meet the requirements of the temperate markets. This situation in all probability

will remain as it is until the demand for these tropical articles far exceeds that of the present.

The higher parts of the Andes also cannot witness any colossal advance (Fig. 333). Rigorous climatic conditions, rugged land, meagre transport facilities, the tremendous cost of providing transportation, and rapid erosion of the mountain soils preclude any large agricultural developments. The highland Indian will continue to

Fig. 334. The Great Western Highway of Venezuela

As this excellent concrete highway has connected La Guaira and Caracas with the fertile land of the Valencia Basin, good highways in other parts of South America are bringing vast territories into greater productivity and making it possible for the inhabitants of those regions to increase their consumption of commodities several fold. (*Courtesy of H. Pittier.*)

practice subsistence farming as he has in ages past. Oppressed, underfed, scantily clad, illiterate, and with little or no economic status, the wretched highland Indian endures his miserable lot and drowns his troubles with coca and strong alcoholic beverages. From him little can be expected. And the known and undiscovered mineral deposits of these areas are all exhaustible.

Without these vast territories, comprising more than half the continent, several areas possess possibilities for a great advance under present conditions of civilization and science. They include especially the temperate plains, the subtropical plateaus, and the sub-

tropical portions of the Cordillera. Of these the largest single area, the southeastern part of the continent, between 20 and 54 degrees south latitude, holds 70 per cent of the total population and 90 per cent of the people in whom European elements predominate; it has 78 per cent of the railway mileage of the continent and supplies the bulk of the export movement. This area and other especially endowed districts with favorable climatic conditions, vast areas of untilled fertile plains and plateaus, a variety of resources, a vigorous population, and the power to attract European immigrants in large numbers stand upon the threshold of a great development (Fig. 334). With peaceful conditions, foreign capital and men, demand for their produce in foreign marts and the desire of their peoples to rise in the scale of civilization, they will undergo a tremendous advance.

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NOTE.—As an aid to readers not familiar with the Spanish and Portuguese languages the pronunciation of a number of Spanish and Portuguese geographical names have been indicated in parentheses.

KEY.—āle, senāte, câre, ăm, ärm, final; ēve, êvent, ĕnd, makēr; īce, ĭll; ōld, ôbey, ôrb, ŏdd; fo͞od, fo͝ot; ch *as in* chair, g *as in* go; ll *nearly like* lli *in* William; ng *as in* sing; n *as in* ink; ñ *as in* cañon; N indicates nasal sound (as in French or Portuguese) of the preceding vowel; ou *as in* out; th *as in* thin; t͟h *as in* then; zh *like* z *in* azure; ' *as in* pardon (par'd'n).

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